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TABLE OF CONTENTS

FEATURE ARTICLES

Some Remarkable Experiments in Lightplanes 280
Air Power of the Major Nations 283
Early Direct-Lifting Stunts 285
Waterman's New Flying Wing 287
Marriott and His Early Avitor 289
Seen at the 1935 Air-Races 291
The Cumulo-Nimbus Clouds 293
Modern and Ancient "Tripods" 295
Some Dope on the Boeing "299" Bomber 296
High-Lights and Side-Lights 297
A New Series of Cartoons 298
British Sliding-Sleeve Engine 299
The World's Planes and Builders 301
Four Recent European Planes 303
Fuel Injection Problem Solved 305
An Autogiro in the Antarctic 307
What Our Readers Are Building 309
A Few Gas-Powered Models 310
Building a Waco Cabin Model 311

PICK OF THE BRIEFS

Italy Gets 'em Ready for Ethiopia 282
Post and Rogers on Last Lap 282
Book Review 286
The Fairey "Fantome" Cannon Plane 286
The Ford Powered Arrowplane 286
The Vought SBU-1 Scout Bomber 288
News From the Plymacoupe 292
A Variable Camber Wing 292
An Ancient Hawk on Display 296
More About the Flying Louse 300
What Our Aero Clubs Are Doing 304
State Aviation Developments 304
Waco Produces an Armed Model "D" 306
The Curtiss Mystery "75" Military Job 306
How a Ford V-8 Engine is Installed 308
The Lear Radio Compass 308
Reginald Denny Builds Models 316

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XUM

Some Remarkable Experiments

by

LESLIE LONG

Designer and builder of the Long Harlequin engine and Longster lightplane.

Front view of the Strut-braced low-wing monoplane.

Front view of the wire-braced low-wing monoplane.

The original and interesting "Hi-Low" wing arrangement devised by Mr. Long.

THE "New Deal" has certainly turned out to be a bitter disappointment for the experimental aviation group.

Instead of the better days we hoped for, we are now more cooped up by restrictions than ever. It seems that experimental work must be done in spite of the Government, rather than with its aid. Commercial aviation is making mighty strides, assisted in every way by unlimited resources of Federal money and brains, but little of these resources are for us. We just don't exist.

It would be safe to say that every man who has built, or hoped to build, a light airplane has wondered and worried about the design. Should it be low-wing, high-wing or midwing? Should it be strut-braced, wire-braced or cantilever? There is very little information to be had on such subjects, insofar as it applies to lightplanes. Rules that apply to a 15-ton transport are not apt to apply to a 500-pound parasol. What we learn we must learn largely through our own efforts without government assistance.

Here in the writer's home state of Oregon, we still have the liberty we are supposed to have as American citizens. There is no telling how long it will last, however, so it seemed it would be well to try to settle a few of the amateur's problems while we still had the chance.

The only way to find out what an airplane will do is to fly it, so I started work on a series of lightships of the type best suited to amateur construction. To date four distinct types have been built and flown. They were, the "Hi-Low", previously described in this magazine, a strut-braced low-wing, a wire-braced low-wing and a standard type of wire-braced parasol.

The same fuselage, with minor alterations, was used in all types. The same motor, a 35 HP "Harlequin" of the writer's own make was likewise used in all of them. Weights, areas and controls were kept as near the same as practical, so that comparisons could be of actual value.

The results have been highly instructive and interesting. In general, they bear out popular opinion fairly well, although several well rooted beliefs were upset. No attempt will be made to give accurate technical data, but instead we will give a loose running description of the ships and their behavior.

The "Hi-Low" was first. This plane was an original design of the writer's and featured an unusual wing. This wing started out as a low-wing, ran out half the semi-span with a marked dihedral and had the outer half of the wings practically flat. It was strut-braced.

The idea was to have the good vision, speed, convenience and landing-gear neatness of the low-wing plus the stability of the high-wing. It had all these in full measure. The plane proved remarkably stable, especially in vertical descent landings, where the air rushing out along the steep dihedral was exhausted through the Friese ailerons giving full lateral control in a complete stall.

The strut-braced low-wing was second. It proved to be the poorest ship of the bunch, climb and speed being poor with no particular compensating virtues.

The wire-braced low-wing was third, and in many ways was the best of the group. It had much the best speed range, landing slower and flying faster than any of the others. It also proved to be lighter and simpler than any of the rest and its climb was by far the best.

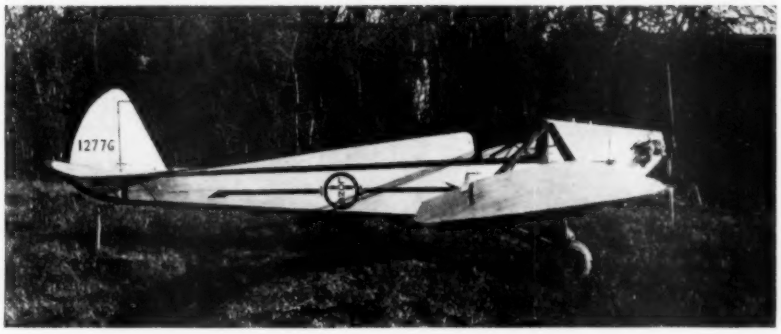
The wire-braced parasol was fourth and in most respects was simply another of the "Longsters" the writer has been building experimentally for several years. Several changes in the structure were made which need not be gone into here. Its performance was simply standard for this type of ship.

The points that will interest the amateur designers most will now be given. No doubt the old old question of high-wing versus low-wing stability will be of greatest interest to most, and we can halt the suspense at once by stating that there is little actual difference. Given enough dihedral, say 4 to 5 degrees, the low-wing is as stable in every respect as the parasol. There is no tendency to upset nor to do anything unusual, whatever. In normal flight, so-called pendulum stability is of little value. It is only when a plane has lost headway that its

In Lightplane Performance

THIS article, by one of our best known and most enthusiastic lightplane and engine designers, is of the greatest importance to the amateur. The author unearths many new facts concerning monoplane performance.

Mr. Long deserves great credit for this extensive experimental work which was completed with his own funds and by his own efforts. It is living proof of the importance of the small builder and amateur to aviation.



A side-view of the "Hi-Low" monoplane.

Rear view of the wire-braced low-wing job.

The wire-braced parasol plane used in the experiments described here.

effect is felt and even then it is no cure-all. In other words, there is some advantage in the parasol, but not a great deal.

One outstanding fact was established. That is, struts above the wing are definitely bad. This was expected and proved to be quite true. Overhead struts were what ruined the performance of both the Hi-Low and the strut-braced low-wing. As soon as the ship is placed in a high angle of attack, the struts break up the flow over the top of the wing which is followed by a great loss of lift.

While the Clark "Y" wing normally stalls or burbles at around 16 degrees, it was found that with the struts it stalled at around 12 degrees or even less. Unless some sort of anti-stall arrangement is discovered the overhead strut is OUT for lightplanes. The only way the good features of the Hi-Low can ever be utilized will be to build a cantilever wing along that design. It is hoped that this can be done in the future.

It was found that the low-wing spins faster than the high-wing and will generally start with a lower angle of stall. Recovery is fully as fast, however, and there seems to be no cause for worry about the angle of design. As is quite well known, the method and style of filleting the junction of wing and fuselage in the low-wing is of first importance.

There is a marked tendency for the wing to burble near the fuselage at high angles, which does not happen in the parasol. This burbling not only affects the lift, but has serious effects on the tail-group.

As the tail surfaces are naturally in the "shadow" of the upper surface of the wing, they at once feel the effects of the broken-up air stream, which results in a pronounced buffeting or flutter of the entire group. Fortunately the condition is curable. Properly designed fillets at the root of the wing will completely eradicate the trouble. More will be said about this in a later article.

The most pronounced difference between the two main types is in landing-speeds. The low-wing has much the best of it. Accurately measured, by having a car run along beside the ships, it was found that the wire-braced low-wing landed at just 25 miles per hour while the parasol lands at 35. That is a big difference, considering that there was only a few pounds difference in the weight of the two ships.

Not only was the landing-speed lower, but the roll after landing was much shorter. The plane acted as though it had brakes. The actual landing was much easier also. Even if brought down at a rapid rate it would tend to slow up quickly just before the wheels struck. Takeoff was much faster, the run required being only half that of the parasol.

All these effects are of course due to the so-called "cushion" of air that is formed when the wing comes so close to the earth. In taxying, the low-wing is far and away the best, there being none of the swaying and rolling characteristics of the high-wing. Neither is the low-wing bothered so much by side winds. This type may be left standing in winds that would be certain to capsize a parasol.

When it comes to vision and convenience, the low-wing again has all the better of it. Vision is as near perfect as possible. The only possible blind spot is directly downward, where there is nothing to look at. Overhead, front and rear and to both sides the outlook is not obstructed by so much as a wire or strut.

In banking around a tree or other obstacle, full vision is had at all times, whereas in the parasol the obstacle is lost to view the minute the ship is banked. Experienced pilots invariably remark about this the first time they fly a low-wing job. When it comes to ease of entering or leaving the ship, the low-wing is unsurpassed. It is no simple trick to get into or out of a parasol, especially when wearing a parachute.

In fact, the pilot is in danger of not

having time enough to clear a parasol in case of a forced jump, while in the low-wing it is only necessary to loosen the belt and dive over either side. The feeling of security this gives is marked. The instinctive dread of being cooped up is entirely done away with.

When it comes to appearance, the low-wing certainly has eye appeal. No ship can look as snappy and trim as a low-wing monoplane. It will take the crowd's eye every time. They always look to be flying faster than they really are, and they have a grace that the parasol never has. The very fact that practically all the later transports and military planes are low-wings makes them look "right" —if you get the idea. The high-wing ship is beginning to look actually old-fashioned.

Before turning to the merits of the parasol, we must mention a few more points for the low-wing. First, is the matter of weight, a highly important factor in lightplanes. Because there are no cabane struts, pylons or center sections, the weight is naturally less. Not only that, but the running-gear, especially the type used on the wire-braced job, is actually lighter than the standard type.

The vees shown weigh but 4 pounds each. They serve not only as running gear, but act as the complete lift-truss, with no extra weight whatever. The gear is very rigid and efficient and a wide tread may be had without weakening the structure. There is also the factor of convenience in working. Everything about the ship is within reach. No step-ladders are needed and there are no blind spots on top of the wing. It is a pleasure to work on such a ship.

And now for the parasol. First thing in its favor is the effective lift-truss. The wing is high enough to give a good angle to the lift wires, even if the span is very great, and this is not the case with the low-wing. In fact, the low-wing is decidedly inferior in this respect. Because of the better angle, the loads in both the lift-truss and in the wing itself are less in the parasol. There is also the factor of ground clearance in the wire braced low-wing. The lift wires come close to the ground and in tall weeds or grass there is distinct danger of nosing over. The parasol is free from this menace.

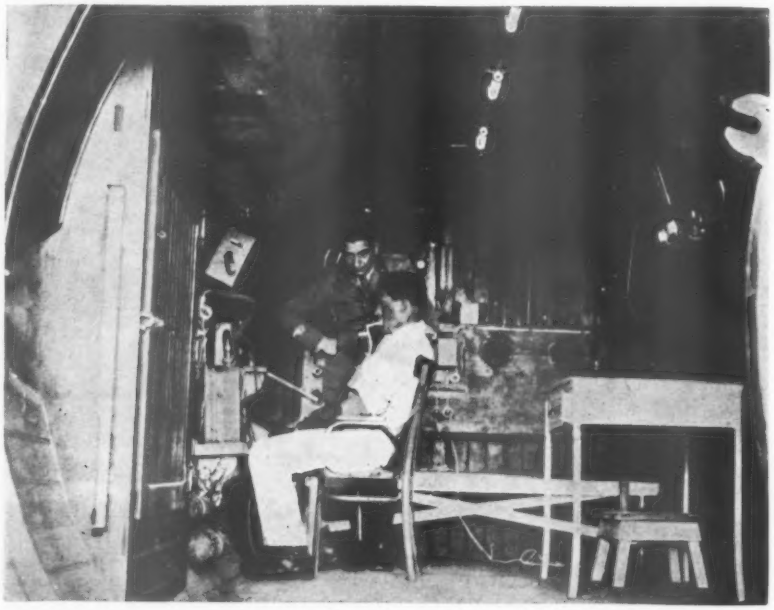
It is doubtful if any other type ship will equal the parasol for angle of climb. The low-wing, with proper fillets, does very well but our experience has been that it will always stall at a lower angle than the high-wing. This is a typical low-wing characteristic, and is due to the fuselage breaking up the airflow at the center of the wing. It is not a serious defect, but it does exist.

The parasol has other advantages. For instance, the problem of gasoline tanks. The wings will always hold any size tank required, while the low-wing is limited to a cowl tank. If that isn't large enough, then resort must be had to a fuel pump, an undesirable feature in lightplanes.

Coming back to the old argument of

(*Concluded on page* 330)

Italy Gets 'em Ready for Ethiopia



Here we see an Italian pilot undergoing physical tests in the altitude chamber. We only hope that this idea does not find favor in the eyes of the U. S. Bureau of Air Commerce.

ITALY, always a firm believer in high-altitude and stunt flying for the officers of her air-force, have constructed an "altitude chamber" as shown above, for testing the ability of the pilots to withstand the low air pressures in the high combat altitudes.

The tank-like structure shown can be exhausted of air to any required degree, thus duplicating in miniature the low-pressure conditions existing high above the earth. In the photo above, the pilot is taking the oxygen test, known as the "metabolic" test. When his normal oxygen consumption is thus determined, he is given simulated flights at 5,000 and 10,000 feet by varying the pressure in the testing chamber.

Post and Rogers on Their Last Lap

WE are fortunate in getting this picture of Wiley Post and Will Rogers in their Lockheed plane, just as they took off for the far north, and only a short time before the disaster that ended the lives of both men.

In spite of the report submitted by the Bureau of Air Commerce, it is the common belief of most pilots that Post, being relatively unfamiliar with seaplanes, "stubbed the toe" of the seaplane by getting one float under water, thus causing the upset. Skimming over the surface of the water at a near 100 m.p.h. would toss the plane up into the air as described by the lone witness.

The Rogers-Post Lockheed seaplane out for a spin, shortly before the disaster that resulted in the death of two of America's best known citizens.

Air Power of the Major Nations

by GEORGE A. WILKINS

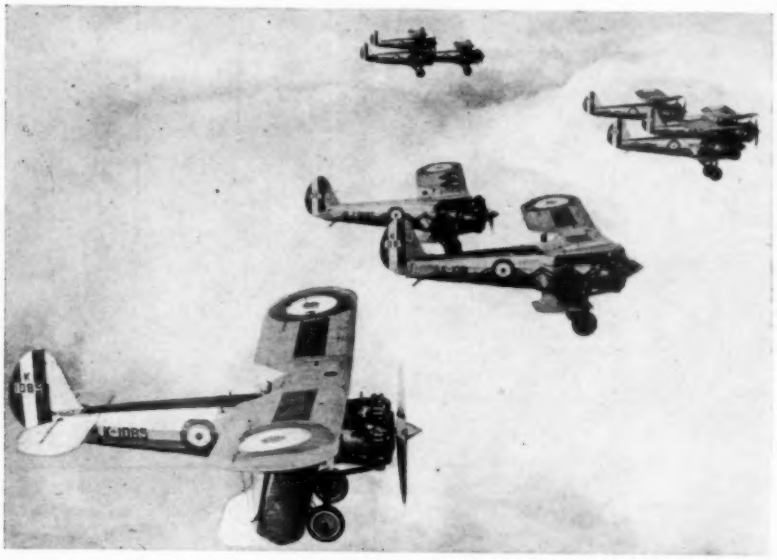
An Analysis Made by an Authority on Military Aviation Abroad, Particularly in Respect to Relative Fighting Values of the Various Aerial Unit Types. His Estimates Are Based Upon Close Observation of the Present Activity in Europe.

NOW that the alarm of war is spreading rapidly over Europe and with aircraft development proceeding with feverish haste, it is both interesting and important that we make a survey concerning the air-strength of the great powers in relation to that of the United States.

Of course, accurate information on air-strength is very difficult, if not impossible to obtain, because such information is justly regarded as an important military secret, but at the same time, we can make an approximate estimate based upon tentative data received from sources that can be considered at least fairly authoritative. So far as possible, of course, each nation endeavors to shield its air-force data against the inquiring reporter, invariably understating its actual strength.

One of the greatest difficulties attending the preparation of accurate statistics upon military aircraft is the isolation of the obsolete and wornout equipment from the number of modern up-to-date craft now available for instant service. All of the military authorities cloud the records by including their obsolete planes in the list with their up-to-date equipment so that a separation is highly difficult.

It is important to note, in this respect, under the present turmoil and state of affairs, that any particular type of ship is likely to become obsolete over night because of the rapid development taking place in all countries. A ship that today is the acme of perfection in performance may, tomorrow, be fit only for the training camps and back-area hangars. These are hectic times in the military plane production plants with new model after new model undergoing its flight tests.



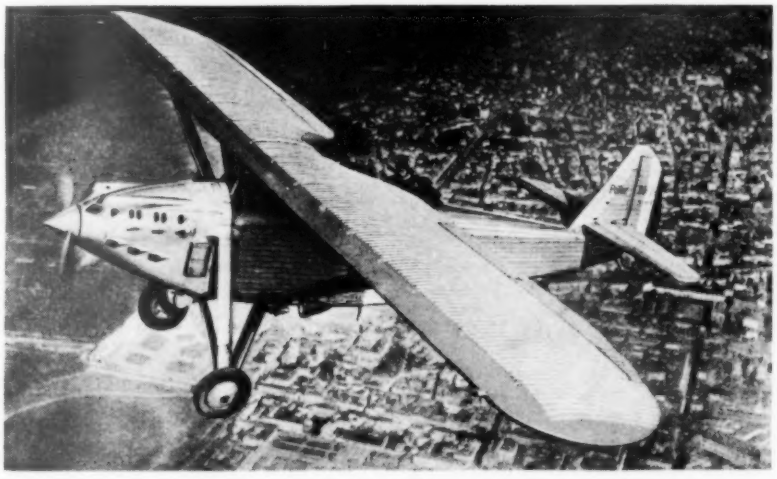
This flight of Bristol Bulldogs, Mark II, is typical of British pursuit plane development. They are powered with Bristol engines that give them excellent performance in speed and rate of climb.

Each country has issued its official statistics which, of course, can be taken with a grain (or several grains) of salt. Each nation demeans its own strength and exaggerates the strength of its opponents as might be expected. And in Table No. 1 is the lineup as prepared from various official sources, and from estimates by the U. S. Aeronautical Chamber of Commerce.

Strange, isn't it, how modest each nation becomes when speaking of its own air-strength France will give no official statement as to her own strength. Germany, who is not supposed to have military aircraft actually has quite a number according to France and the Aeronautical Chamber of Commerce. But, no matter how they may disagree on other points, all of them give Russia a credit of approximately 3,000 planes. We believe, however, that the estimate of the U. S. Aeronautical Chamber of Commerce is nearest to the truth, for this association has no axe to grind in the compilation of these figures and it compiled the table from many dependable sources of information.

Now, we come face to face with the question of utility. Just what percentage of these planes are right up to the minute? What percentage could be thrown directly into the conflict at a day's notice, and how many are capable warplanes?

The answer is difficult except in the case of the single-seat fighters or pursuit ships of which only limited additions have been made in European airforces. England and France have added only 50 planes to their force in this division since 1931, therefore, the original single-seater pursuit group must be getting rather frayed out. It explains, at least partly, why the speed of the European bombers and two-seaters frequently exceeds that of the single-seat fighters. The case is quite different in the United States where notably large additions have been made within the past two years in the single-seater divisions. Since



The French two-seat fighter, an all-metal Potez 39, is a well known component of French fighter squadrons. The corrugated metal construction is quite unusual in planes of this type.

1931, Italy has added only 60 single-seaters.

In Table No. 2 we have listed the average relative performances of the various classes of planes from 1928 to date. The improvement in the performance of the fast two-seater fighters, attack types and bombers is notable, eclipsing that of the single-seaters in years past.

Many of the two-seat fighters are now taking the place of the former single-seaters as a defense against the bombers. The heavy armament of the new bombers, bristling with machine guns, makes it desirable to employ a two-place machine for defense against these bombers. We see from the above table that the average bomber of today has a speed greater than that of the 1932 single-seater and it is entirely likely there are numbers of these single-seaters still in service.

With the bomber assuming the position of greatest importance, let us investigate the probable number of these planes in service, and the number of attack planes available.

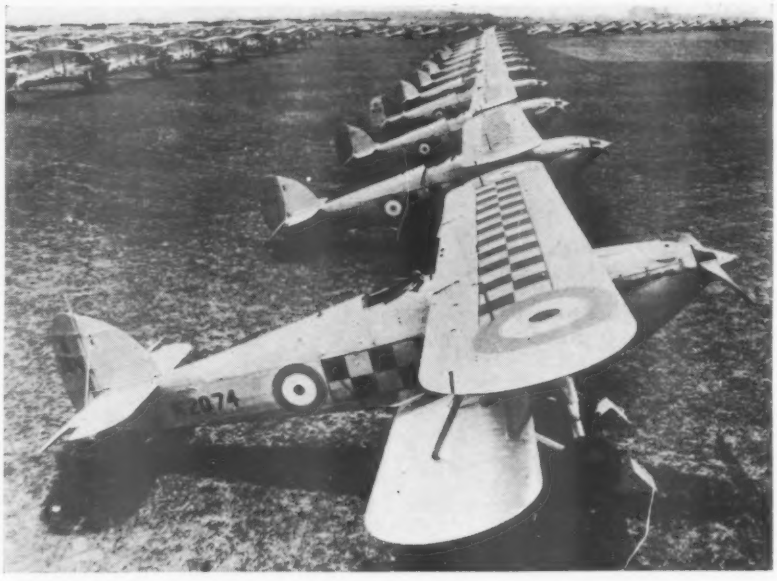
To estimate the potential strength of the bombing division we should add to the above tabulation, all of the fast airline transport ships in service which could become effective bombers with comparatively little readjustment. In this event, the United States would be paramount above all other nations because of the tremendous number of transport planes in this country that could be mustered into service in an emergency.

Among the very modern types of bombers are the English Heyford, the American Boeing "299" yet in its experimental stages, the fast Martin bombers now in service, the French Farmans and the Russian giants. The performance of these ships is not definitely known, but it is believed that the very latest types are well on their way to 260 m.p.h. In 1928, a first-line bomber could carry 1,500 pounds of bombs for 245 miles and return. Today, the first-line bomber carries 6,500 pounds of bombs for 435 miles and return. This is a tremendous increase in the short span of seven years.

But we are paying the price for this performance. In 1928, a bomber cost approximately $50,000. Today, the latest word in bombers will range from $200,000 to a reputed $500,000. That is the price of speed, climb and duration. Double the speed and the cost is increased more than four times.

TABLE 1. TOTAL MILITARY AIRCRAFT OF THE GREAT POWERS

Nations	English Official Estimate	French Official Estimate	U. S. A. C. C. Estimate	German Official Estimate
France	1,665	....	3,600	2,061
England	1,550	1,850	2,800	1,069
Italy	1,189	1,206	2,300	1,053
Japan	1,050	....	1,850	2,050
Russia	2,500	3,400	3,000	3,170
United States		1,890	2,060	3,158
Germany	1,122	1,050	600	....



English fighting planes lined up, row on row, at the recent military maneuvers. This picture was taken at Mildenhall Airdrome in England where the planes were in readiness for a review by the King.

TABLE No. 2. COMPARATIVE PERFORMANCE OF MILITARY PLANES
(Top speeds taken at 15,000 feet.)

Years	Top Speed Increase M.P.H.			Climb in Feet Per Minute		
	1-Seater Fighters	2-Seater Attack Fighters	Bombers All Types	1-Seat Fighters	2-Seat Attack Fighters	Bombers All Types
1928	155	125	122	1050	675	450
1931	175	125	130	1380	850	600
1932	200	135	130	1700	1065	710
1935	250	225	210	2775	1600	1050

The British Fairey "Fantome", recently produced, is a fighter designed as a defense against bombers and for attack missions. It has to hustle along to catch bombers hence it has a top speed of 248 m.p.h. Likewise it has to get upstairs in a hurry which results in a climbing speed of about 2,800 feet per minute. But the most novel point is the 20 m.m. cannon, the four machine guns and the four 22-pound bombs that the Fantome carries.

It is rumored, though we have no accurate figures to bear out the statement, that new Curtiss high-wing monoplane fighters now going into service have a performance better than that of the Fantome, which we devotedly hope is true. In respect to American bombers, we know that the Martin B-16 bomber now in service and the Douglas bomber recently tried out have a superlative performance, and that the new Boeing 299 bomber promises to even beat their mark.

Emergencies arise quickly in war and it is not only the nation that has the most effective planes on hand that has the advantage but it is the nation that can produce additional machines quickly with improved performance that wins. In war, planes go out of fashion overnight and the whole thing sums itself up in the end as a battle of wits between the designers and the producers of planes in the contesting nations.

The United States has always been noted as being a nation of outstanding machine designers and engineers and we should have no fear on the score of plane production so long as the engineers are left to their own devices and are not interfered with by politicians as was the case in the last war.

In 1917-1918 we saw the sad spectacle of competent engineers baffled and confused by a myriad of meddlesome bureau chiefs, each with his private political axe to grind. Due to meddlesome politicians airplane designs were obsolete long before production was started and we were finally compelled to rely upon our allies for service planes.

We should start cleaning house now. Insure that our engineers will be given full reign and that there will be plenty of fully equipped plants available for rapid production on short notice.

TABLE No. 3. NUMBER OF BOMBERS

Nations	Day Bombers Light Types	Night Bombers Heavy Types
France	80	240
England	250	110
Italy	120	110
Japan	50	15
Russia	750	250

Early Direct-Lifting Stunts

DIRECT-LIFT flying machines have long been the goal of inventors, dating back from the days of Leonardo da Vinci, but so far, the autogiro has come the nearest to this desire of any type yet constructed.

To list all of the helicopters, ornithopters, orthopters and wing-flappers would be to fill a large book, but the three early types shown here will give a good idea of the various ships that were constructed long ago.

LEONARDO DA VINCI, the world's oldest aeronautical engineer, famed more for his artistic ability, however, than for flying, doped out the first helicopter. He used a single vertical prop which, needless to say, never accomplished its destiny.

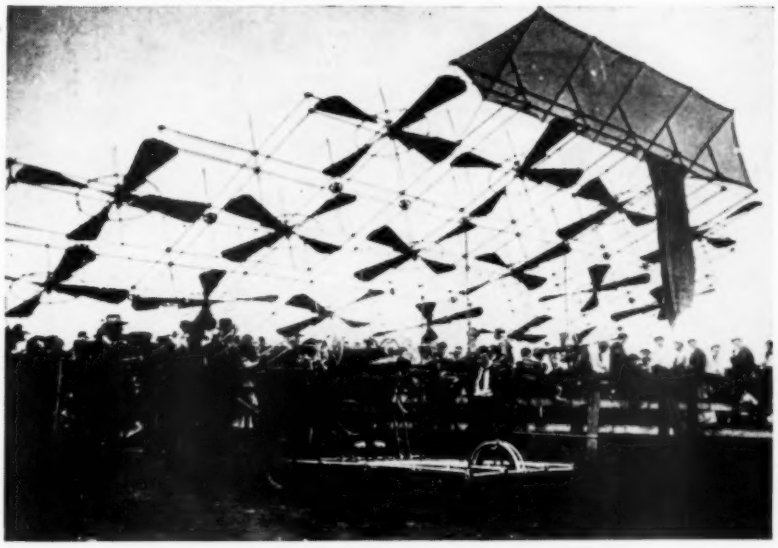
The big idea of the helicopterists (if there is such a word) is to worm their way straight up in the air by means of an airscrew. But, after all these years the best that anyone has done was to screw up to a perilous 14-feet and then come down with a heart-sickening thud. But they keep at it just the same, and always will, so long as any money is lying loose around the house.

At the top of the heap of pictures, at the left, is the sixteen propeller what's-its-name devised by an American by the name of Kimball. If there is anything in numbers, this helice collection should have arisen, but it remained firmly on the ground in spite of all the gas that he could give the engine. This was built in 1908, so we can't accuse him of being a dreamship artist.

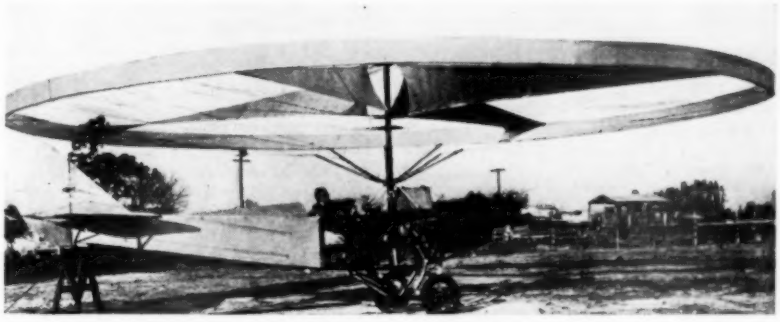
Second, is a heliocopter designed and built by an inventor that should have known better. The inventor was Frederick Gerhardt, chief of the Aerial Research Institute, Dayton, Ohio. His object was to employ a very large slowly revolving airscrew having a large bearing area on the air, but it was also earth bound. Mr. Gerhardt applied all of the propeller principles then known to his ship, but about the best that was accomplished was a loss in weight when the props were revolving full tilt.

Third, but not last, is the Jonathon E. Caldwell paddle-wheel ship, with two sets of steamboat type paddles having feathering surfaces, so popular in Europe a short time ago. In spite of Mr. Caldwell's enterprise, airplanes are still being built and sold at intervals. He was just one more man that failed to take ground compression into account.

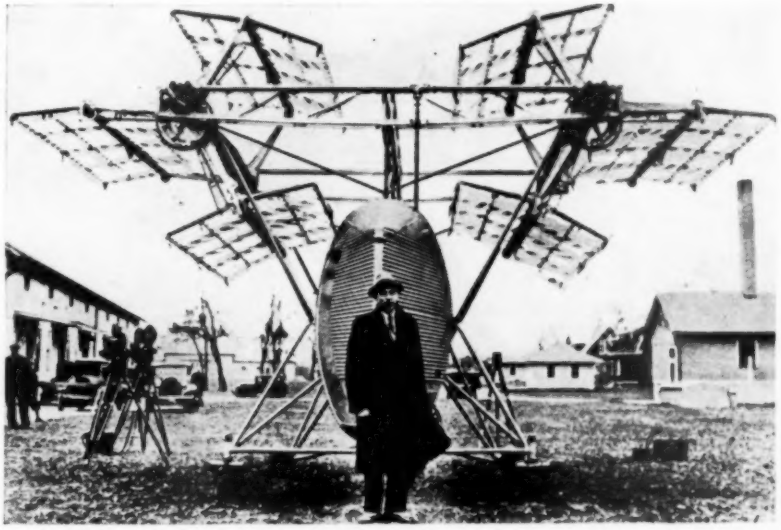
The principle of gaining lift by the downward acceleration of air is sound, providing that you can get enough air to accelerate at a low velocity. The great trouble is to embrace a sufficient area of air column with propellers structurally sufficient to stand up under the racket. All helicopters that have lifted off the ground have only lifted far enough to lose the ground compression effect, and then refused to go farther.



There was a flock of propellers in the 1908 Kimball rig.



The single Gerhardt propeller was of exceptionally large diameter.



And now we have the Caldwell paddle-ship with us.

Who's Who In Aviation

"HEROES OF THE AIR", by Chelsea Fraser, fully meets the requirements of readers interested in the biography of famous pilots. This is borne out by the fact that it has just reached its thirteenth printing.

This latest edition contains all of the famous flights and pilots up to the summer of 1935, making it an up to the minute reference book for those who follow all the doings in aviation. It contains 56 maps by the author and fills 744 pages brimful of aviation data. It is priced at $2.50 and is published by Thomas Y. Crowell Company, New York.

A New Waco Catalogue

A VERY attractive catalogue has just been issued by The Waco Aircraft Company, Troy, Ohio, which describes current Waco products in both the standard and custom lines. And while some very beautiful cabin jobs are displayed, yet it does the writer's heart good to note that the Waco open-cockpit, F-5, is still in the running with various refinements added. Somehow, an oldtimer's heart always goes out toward an open job of this type more than for a cabin ship, no matter how elaborate it may be. And the writer has had a lot of time on the Waco "F's" of past years.

No radical changes have been made in any of the models, but by suitable refinements, 7-m.p.h. have been added to the Waco cabin planes with even a roomier and more comfortable interior than before. The full N.A.C.A. cowl has been made more readily removable and the inner cowl around the accessories group is now instantly removable. A curved safety-glass windshield improves visibility by eliminating two diagonal frame members used in the earlier models. However, for the complete story, we recommend that you send for the catalogue.

A Popular History of Aviation

"SKY HIGH," a popular type history of aviation by Eric Hodgins and F. A. Magoun, has just appeared in a second edition. This is a very comprehensive, accurate and highly interesting history of flying that has been brought right up to the last minute, including the Pan American Clipper Ships.

We have, from time to time, in the course of our labors, read many aviation histories, some good, some indifferent and some very poor. Some were accurate, some inaccurate and others went prancing along with complete indifference to facts or reason, so that we were inclined to "lay off" any more literature of this sort.

But—after a careful scrutiny of "Sky High" we reverse our prejudice against histories and very sincerely recommend it to those of our readers who wish to avail information upon the development and personnel of flying. It is published by Little, Brown & Company, 34 Beacon St., Boston, Mass. Price $2.75.

The Fairey "Fantome" Cannon Plane

The Fairey "Fantome" in flight, one of Britain's high-performance fighting planes.

ONE of the latest British high-performance fighting planes is the Fairey "Fantome," a high-speed cannon plane produced by the Fairey Aviation Company, Ltd., Hayes, Middlesex, England.

This pursuit plane represents the ultimate in modern aeronautical and ordnance engineering and it has passed specifications and requirements that are far in excess of any demands so far proposed in Europe. Every possible refinement has been incorporated in the design that would improve its performance or make it a more effective weapon.

Trials show that its speed exceeds the specification requirements for 248 m.p.h. at a elevation of 16,400 feet and that it climbs to this elevation in slightly less than six minutes or at the rate of 2,733 feet per minute. When we consider that this vertical climbing velocity is somewhat greater than 30 m.p.h., directly upward, we can gain some idea of its capabilities. But, in spite of the high top speed, the landing speed is below the 74.5 m.p.h. specified.

The cannon, which is the leading feature, is not really so much of a cannon, having only a 20 mm. (0.80-inch) bore, not much larger than the 0.50-inch machine-gun used in the U. S. Army Air Corps. However, the increased size is sufficient to improve the range and accuracy of fire over that of the machine-gun. Guns larger than this were tried out during the World War on Spads and Bugatti engined planes, but as the structures of the planes of that day were not sturdy enough to resist the recoil, the large guns were discontinued.

The "cannon" fires through the bore in the propeller shaft and lies between

(Concluded on page 322)

The Ford Powered V-8 Arrow Lightplane

IN the October issue of POPULAR AVIATION, we printed a full description and showed the layout drawings of the V-8 Arrow 2-seat sportplane. Our readers took such an interest in this little ship that we are showing the photo of it below, by demand.

As before explained, the Arrow is powered by a Ford V-8 engine and the maintenance and operating cost are correspondingly low. On test, it shows a consumption of five gallons of gas per hour at a cruising speed of 100 m.p.h. The top speed is said to be in the neighborhood of 110 m.p.h., which is very good for this rating.

A side elevation of the V-8 Arrow indicates the short cowl length and engine compartment possible with a Ford V-8 engine.

Waterman's New Flying Wing

by ROBERT C. LUNCH

A description of the new tailless plane recently devised as a runner-up for the Bureau of Air Commerce project for a $700 sportplane. It has many interesting features well worth studying.

AS the Waterman tailless airplane came to a landing at the Washington, D. C., Airport, at the conclusion of a flight from California, it marked the near end of man's long struggle, since the first days of flying, to find a flivver plane that could be manufactured cheaply enough to let every average working man own and fly one.

The airplane that is destined to fulfill these dreams, it is believed by many, was flown to the capital by John H. Geisse, Chief of the Development Section of the Bureau of Air Commerce, who was making his first transcontinental trip as a pilot. Secretary of Commerce Daniel C. Roper; Assistant Secretary of Commerce J. M. Johnson; Director of Air Commerce Eugene L. Vidal, and other Commerce Department officials, witnessed the arrival of the new craft at the airport, and extended their congratulations to the pilot.

The Waterman, a two-place monoplane, at present is powered by a four-cylinder inverted, air cooled aviation engine of 95 horsepower. Its distinctive feature, of course, is the absence of a tail. Control surfaces are at the trailing edges, and tips of the wings, which sweep back from the nose of the fuselage. It is a pusher, with the engine in the rear, which materially augments visibility forward and down from the pilot's seat.

The undercarriage is of the three wheeled type with the main wheels to the rear, to prevent ground loops and nosing over. It has a top speed of 114 miles per hour. Its simplicity of construction makes the Waterman particularly adaptable to production in quantity with prospects for a low sales price and maintenance cost.

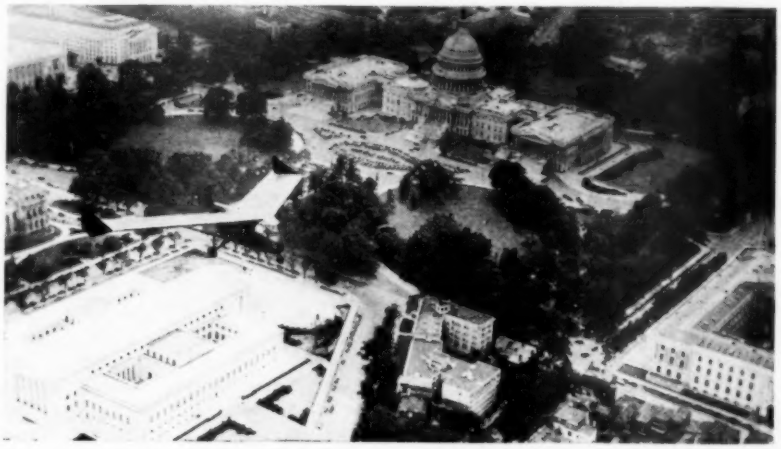
Partly to demonstrate that the craft is one which may be flown cross-country safely and efficiently by an airman of limited experience, Mr. Geisse, a novice as far as present day types of airplanes are concerned, went to California to accept delivery of the ship and fly it to Washington.

The plane left Santa Monica, August 2, and flew by easy stages to Tucson, Arizona; El Paso, Texas; Fort Worth, Texas; Shreveport, Louisiana; Atlanta, Georgia; Winston-Salem, North Carolina; Quantico, Virginia; and thence to the Washington, D. C., Airport.

As the pilot stepped from the plane, he patted its nose, which is the windshield and remarked, "She's a good girl and can't be fooled."

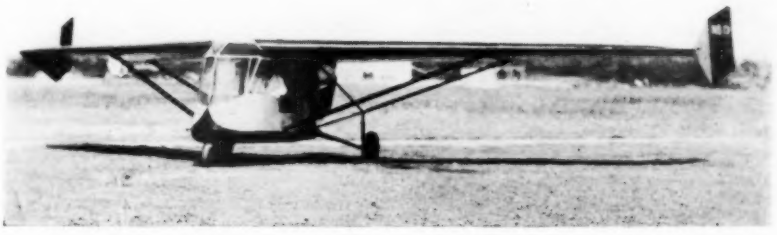
Later on in the day, while in a more formal mood, he said, "The Waterman airplane is almost fool-proof and is very close to being absolutely so. In the

A Few Views of the Waterman Tailless Airplane



The Waterman plane flying over Washington, D. C. This photo clearly shows the wing arrangement and the controls mounted on the wing tips.

A rear view of the Waterman plane showing the engine cowling and landing gear arrangement.



A front view of the Waterman plane shows that it has excellent visual range.

condition in which it was flown from the West Coast, the airplane could not be stalled or spun by any normal or reasonably abnormal use or abuse of the controls."

And that, mild as it may seem, is the reason behind many airplane factory executives, engineers and mechanics walk around wondering when the new low priced planes that anyone can fly is going to put them out of business.

Ever since the Bureau of Air Commerce was founded, it has striven to attain one great end; safety in the air. First, it started on the safety of the passenger planes, then army planes, then private planes. Then it spread to getting more persons to fly. After that it became interested in the personal airplane that could be bought for a few hundred dollars.

The prime factor though, that the Department could not forget for one moment, was generally lacking. That was safety. Either the plane under consideration would not land properly, or it cost too much to build, or something else was wrong with it somewhere.

The autogiro, perhaps, was the nearest thing to the personal plane that the Bureau had seen up until this date. Its main objection however, was its expense. An Autogiro costs approximately two thousand dollars or more unassembled and unshipped.

Another of its objections lay in the storage space or hangar space it required. All reports to the contrary, the point was never reached where the vanes could be folded back with very little trouble and laid along the top of the fuselage. The Waterman overcomes these two undesirable features. It is expected, if mass production ever gets under way, that it will sell for what about a Ford automobile costs today, and will occupy about the same amount of space.

The tailless feature of the airplane offers possibilities of reduction in production costs, and also reduces the hangar space required. By putting the plane into a hangar wing first, or sidewise, a hangar of about 22 foot span can be used. As hangar construction costs mount rapidly with increase in span, this is an important consideration. In the event that roadable airplanes bodies are found practicable, the tailless feature will have an added advantage as only the wings will have to be removed.

Another popular objection to so called "family planes" was the great amount of space they needed to land and take off. Again the autogiro pilots and manufacturers thought it had been solved. But later, and more conclusive tests definitely determined that other, conventionally designed planes, already being turned out in mass production, needed no more room. True, they could not be flown as easily as the autogiro, but they could get off the ground in as much space.

(Concluded on page 336)

The Vought SBU-1 Scout-Bomber

Three-quarter front view of the new Vought SBU-1 Scout-Bomber for use with the U. S. Navy's aircraft carriers.

A NEW scout type bomber for use on the aircraft carriers of the U. S. Navy has recently been produced by the Chance Vought Aircraft Corporation.

This new plane, known as the Vought Type SBU-1, is a biplane equipped with a Twin-Wasp Junior engine of 700 horsepower. Eighty-four of these planes are now under construction at East Hartford, Conn., and it is likely that the order will be completed at an early date.

The engine cowl has adjustable flaps, a new development, and flaps are also provided on the trailing edge of the wing for making slow landings on shipboard. A Hamilton-Standard controllable pitch propeller is employed which improves the takeoff and climb.

Front elevation of the Vought SBU-1 Scout-Bomber showing the trailing edge flaps depressed.

More Upheaval Concerning the $700 Plane

WHEN the $700 lightplane project was first launched by the Bureau of Commerce under the direction of Eugene Vidal, POPULAR AVIATION violently protested this move in the "Airy Chat" and elsewhere. But that howl was to prove one of the forgotten incidents of history.

And now, arises a violent and virulent howl from another direction that is becoming overwhelming in its intensity. Our engineers, automotive and otherwise, have just discovered, two years after we started the ball rolling, that the $700 idea ain't just what it should be. They are red in the face and shouting from the housetops about something that should have attracted their attention a long time ago.

But what gets our nanny goat over the whole affair, is the tirade of abuse leveled at $700 airplanes, low-priced sportplanes, amateurs, amateur flying, etc., by William B. Stout, who should know better. Mr. Stout, president of the S. A. E., in a recent article, makes some very sweeping condemnations of amateur planes equipped with automobile engines which we are sure that he would re-consider if he had as much contact with these ships as we have. Quite contrary to Mr. Stout's statements, we have seen Ford powered planes put up a very good performance at a minimum cost of maintenance and operation—and what more could any owner want?

Marriott and His Flying Avitor

by MARVIN MARTIN

The history of an early American flying machine that has received but little notice by the press. A peculiar patent situation of his time prevented him from obtaining a patent on his invention with which he made flights 34 years before the Wright Brothers flew.

BECAUSE, in the opinion of the United States Patent Office of 1881, "no plane could ever hope to fly without the aid of gas as a supporting medium", Frederick Marriott was never able to claim official credit for invention of a successful steam driven aircraft, although a model of one of his previous planes made many successful flights 34 years before the Wright Brothers.

The brief letter refusing the patent—I have seen the original letter—gave no better reason for setting aside the San Francisco inventor's 38 years of experience in the then fabulous field of aeronautics.

Frederick Marriott, born in 1805 in Somerset, England, is described by Vizitelly (in *Glances Back Through 70 Years*—published in 1893) as "the rummiest fellow on earth, always planning new ventures."

His first effort to work out the problems of air navigation was in conjunction with H. S. Henson and William Stringfellow, who had been experimenting with gliders. They enlisted the aid of Mr. Roebuck, a member of Parliament, to make application to Parliament for an act of Incorporation for the Aerial Steam Transit Co. Patent No. 9478 of 1842.

Mr. Roebuck moved to bring in the bill on March 24, 1843. The bill proposed, "certain improvements in locomotive apparatus and machinery for conveying goods and passengers from place to place through the air, part of which improvements are applicable to locomotive and other machinery to be used on water and on land."

A steam engine was specified, incorporating the plan of an enormous monoplane built of bamboo braced with wires. The surface of the wings was to measure 4500 square feet. These dimensions, they figured, would lift ½ lb. to the square foot, including machinery, fuel and load. A steam engine of 35 to 40 H.P. was to drive it, propelling two six-bladed propellers with the blades set at an angle of 45 degrees.

But the company's shares did not sell. Roebuck, no doubt fearing to risk his reputation for sanity among his fellow statesmen by backing such an outlandish idea, washed his hands of the inventors. Marriott remained enthusiastic. Henson, discouraged and impoverished, gave up. His model plane is still preserved in the Science Museum of South Kensington, London. Marriott in his enthusiasm sunk most of his funds and finally sold his shares to Stringfellow.

Eventually, Marriott sought the city of opportunity, San Francisco, California. Restoring his finances by setting up a bank in the fast growing city, he returned again to flying. He established the San Francisco News Letter, a weekly newspaper, calling it the official organ of the Aerial Steam Navigation Co., (incorporated on Aug. 31, 1866) and used it as a means of supporting his aerial experiments. He had early realized the need for arousing public interest in flying and his paper had frequent announcements promising or postponing a first public flight of his steam propelled plane, which he called an "Avitor".

On July 2, 1869, the first flight was made at Shell Mound Park, a race-track not far from the present Mills Field, San Francisco Municipal Airport. An old copy of the *San Francisco News Letter*, July 3, 1869, fortunately not destroyed by

Frederick Marriott, born 1805, the inventor of the Avitor described in the accompanying article. He made a successful model flight on July 2, 1869.

the San Francisco fire of 1906, gives an eye-witness account:

"An engineer's trial trip of the model steam carriage just completed at the Avitor Works, Shell Mound Park, was made yesterday (Friday) morning, in the presence of the constructing engineers, several of the shareholders of the Aerial Steam Navigation Company, a number of the employees of the San Jose Railroad, who happened to be in the vicinity and of residents in the neighborhood. The morning was beautiful and still—scarcely a breath of air stirring. All conditions were most favorable to success.

"The gasometer was fully inflated at 15 minutes past 6 o'clock and the model was floated out of the building and across the race-track to the open space in the center. In six minutes steam was got up—the rudder set to give a slight curve to the course of the vessel—and the valves opened. With the first turn of the propellers she rose slowly into the air, gradually increasing her speed until the rate of five miles an hour was attained.

"The position of the rudder caused her to describe a great circle, around which she passed twice, occupying about 5 minutes each time. Lines had been fastened to both bow and stern, which were held by two men who followed her track and had sufficient ado to keep up with her at a 'dog trot.'

"As she completed describing the second circle, a pull given to the head-line, unintentionally caused the rudder to shift to a fore-and-aft position, when the model pursued a straight flight up the race-track about a quarter of a mile; she was then turned round, and retraced her flight to the point of departure; whence, being duly guided, she entered the building. The fires were 'drawn' and the first extensive flight of a vessel for aerial navigation was accomplished. The total distance traversed was a little over a mile.

"The appearance of the vessel in the air was really beautiful. As seen in the building, she looks cumbrous and awkward—just as a ship looks cumbrous and awkward on the stocks. The change of appearance, as she is circling gracefully through the air, is equal to that of the same ship when seen in the water. The first moment of opening the steam-valve was one of suspense; as the vessel rose and forged slowly ahead, the suspense was scarcely dissipated; but in a very few seconds her speed increased—in obedience to the rudder she commenced to swing around the curve—the men at the guys broke into a trot, and cheer upon cheer rose from the little group. In years to come it will be something for these men to tell, that they were present at, and saw the first mile-flight ever accomplished in the grand discovery of aerial navigation."

Two days later, July 4, 1869, the first public flight was made and about one hundred invited guests witnessed it. The wind was blowing hard and gusty, so the demonstration was given inside the large building which was being used as a hangar. The Avitor rose several feet off the floor, flew from one end of the building to the other and back again, being controlled as before by men holding guy ropes on the ground. Minor repairs were made to stop a leak, several rips in the fabric had to be sewed up, then another demonstration was given which was more successful.

The Avitor was patented on Nov. 23, 1869. It is described as being "a large working model, shaped like a cigar, both

ends coming to a point. It is 28 feet long, measuring 11 feet from top to bottom, and 8 feet in width. These are the measurements at the center, from which point it gradually tapers off toward either end.

"Around it lengthwise, and a little below the center, is a light framework of wood and cane, strongly wired together and braced. Attached to this frame, and standing up as they approach the front of the carriage, are two wings, one on either side. They are each five feet wide at a little back of the center of the carriage, and do not commence to narrow down until they approach the front, where they come to a point.

"These wings are made of white cloth fastened to a light framework, which is braced securely by wires. The main frame is secured in place by means o strong ribbons which go over the car riage and are attached to corresponding portions of the frame on the other side. To the frame at the hind end of the carriage is attached a rudder or steering gear, which is exactly the shape of the paper used in pin darts, four planes at right angles. This, when raised or lowered, elevates or depresses the head of the carriage when in motion; and when turned from side to side guides the carriage as a rudder does a boat.

"At the center and bottom of the carriage is an indentation, or space left in the material of which it is built, in which the engine and machinery are placed on framework. The engine and boiler are very diminutive specimens, but they do their work handsomely.

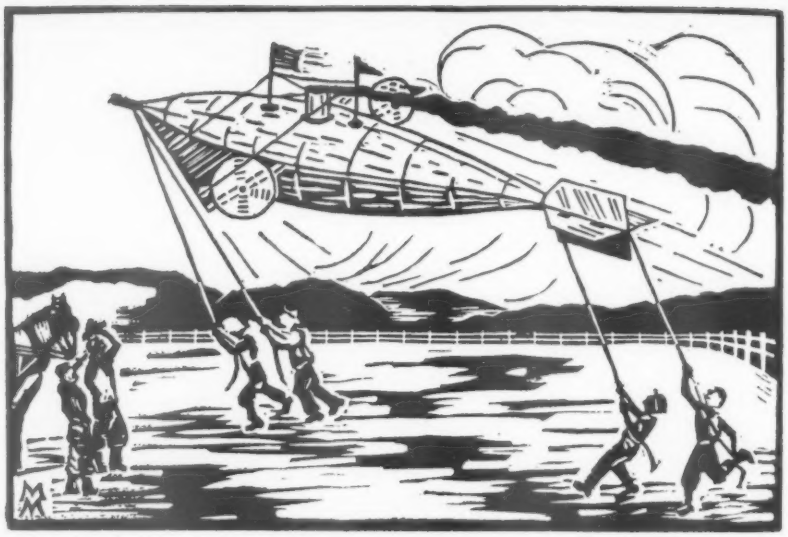
"The boiler and furnace are together only a little over a foot long, four inches wide and five or six inches in height. Steam is generated by spirit lamps. The cylinder is 2 inches in diameter and has a 37-inch stroke. The crank connects by means of cog-wheels, with tumbling rods which lead out to the propellers, one on either side of the carriage. The propellers are each two bladed, four feet in diameter, and are placed in the framework of the wings.

"The boiler is made to carry eight pounds of steam. When not inflated, the carriage weighs 84 pounds. The balloon has a capacity for 1,360 feet of gas. When inflated and ready for a flight it is calculated to have the carriage weigh from four to ten pounds."

The balloon was inserted within the framework in order to lighten the deadweight of the plane and its steam engine; the amount of gas used was not sufficient to l ft the plane off the ground.

The San Francisco Daily Times reported that, "while yet the machine remained, as it were, perfectly dormant, resting upon the floor with less than sufficient buoyance to raise itself—requiring additional aid to relieve it from connection with the earth—the machinery was put in motion and the propellers commenced their revolutions.

"At once life was imparted to the whole body, and it arose promptly and gracefully and took its flight into the air under guidance of the rudder, thus establishing the astounding fact that it had power and could fly; and giving



Marriott's Avitor on its first experimental flight. This first trial machine was a very large model propelled by a steam engine. From a linoleum cut made by the author.

proof that the grand problem had been solved.

"The carriage mounted nearly to the roof with a firmness and steadiness equal to the movements of an ocean steamer on smooth water. The guests cheered long and loud, and many fairly danced with delight at the success. The trip back and forth was performed several times with the same success."

Immediately, upon this public exhibition, the local press was full of the wonderful invention, and much excitement prevailed in the United States and Europe when the news arrived of the entire success of the model Avitor. The London and China Express said: "They (Californians) have voted the railroad slow and intend to make the trip to New York in 24 hours."

The Overland Mail said that "the first extensive flight of a vessel for aerial navigation is accomplished, and the grand problem of atmospheric locomotion is realized." The London Dispatch said: "The wonderful California flying machine, we are informed, will soon wing its way across the Rocky Mountains from San Francisco to New York, to the great loss no doubt of the now superfluous Pacific Railway."

Even before the successful flight, the San Francisco Bulletin on June 28, 1867, published a Honolulu letter in which a Russian officer of the gunboat Gornorstoy, just arrived from Callao, "wanted to know of me if the new flying machine lately invented in America had commenced taking passengers yet." Pan American Airways hopes soon to give the Russian officer the happy answer that he may fly from Honolulu to San Francisco. The answer is only 68 years late!

Marriott's own vision of what he could do provokes admiration and smiles from those who take aviation seriously. We read in the San Francisco News Letter: "Next in point of speed to the telegraph, it opens communication between distant points, it leaves the steam engine, the ship and the railroad to drag their heavy burdens of freight in useful, plodding carriers, while with quick dispatch it bears its men and messages through the air.

"No savages in warpaint shall interrupt its passage over and across our continent. No malaria, or hostile tribes nor desert sands shall prevent the exploration of Africa, no want of water, the examination of Central Australia, nor ice flows or ice mountains the search for the Northwest Passage.

"No underground railways will be needed to accommodate the crowded thoroughfare of Broadway, no circuitous passage to find a narrow isthmus between continents, no waiting for trade winds; no necessity of lying becalmed under tropical suns; no extortions from huge corporations who monopolize the great routes of travel. No tax for crossing New Jersey; no states under tribute to railway companies. Man rises superior to his accidents when for his inventive genius he ceases to crawl upon the earth and masters the realms of upper air."

The Avitor was brought from Shell Mound Park to the Mechanics Pavilion in San Francisco, the largest hall in the city, where it was placed on display. Daily flights were made in the building at 9 A. M., 11 A. M., 2 P. M., and 5 P. M., the prices of admission being 50 cents for adults, and 25 cents for children.

"Thousands visited it there, and all expressed themselves satisfied that aerial navigation was an established fact," according to the San Francisco News Letter. "Nevertheless, there were great difficulties to contend with. The numberless gas fixtures in the hall were obstructions to continuous flight and absolute impediments to the machine soaring to the roof.

"Still, the easy, graceful, calm power of motion through space was eminently exemplified in this, the first Avitor, that fullfilled all the requisitions for aerial

(*Concluded on page* 318)

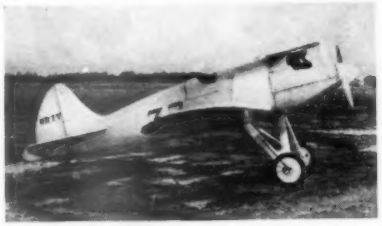
Seen at the 1935 Air-Races

by J. B. RATHBUN

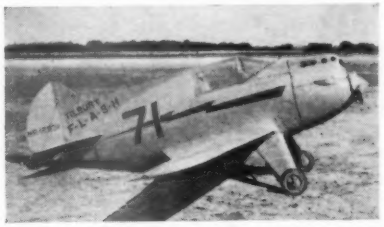
A few high-lights and snap-shots taken at the annual holacaust held this year in Cleveland, O. Just to appease a few of our readers, Mr. Strolmeyer took the shots below.

And Art Chester was among those present.

The U. S. Navy contributed this F4B-3.



Howard's old racer Pete was there.



You've all seen the Tilbury Flash before.

Cecil Allen crashed and was killed.

WELL, they pulled off another air-race at Cleveland for the benefit of the aeronautical sciences and one that was not so hot, according to all accounts. Mr. Strohmeyer, our representative and photographer at the races, was rather disappointed in the aviation features but was all enthused over the trick driving exhibition with the beer-truck horses. Those were sure some horses, according to Mr. S.

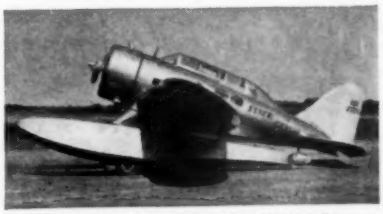
THERE was a big hub-bub and a lot of big noise immediately preceding the Cleveland air-races this year and mighty was the talk about super-speeds and super-everything. But, so far as pure brute speed was concerned, it all dwindled down to practically zero when the big airplane development boys got on the job.

In short, the air-racer's contribution to airplane speed development was shy a good many m.p.h. this year. Mebbe the air ain't what it used to be—or something. But, on the other hand, Sir Malcolm Campbell trundled his engine on wheels, known as the "Blue-Bird", to a brand new World's record of 301.33 m.p.h., which is middlin' close to the U.S.A. airplane record of 304.98 m.p.h. and far better than anything that has yet been done at the air-races.

It was 'way back in 1932 that Major Jimmie Doolittle set up a record on a Gee-Bee monoplane that has stood for a long time. He hurried along at a speed of 252.69 m.p.h. that year which was a little over 32 m.p.h. better than was done this year in spite of all the big talk. If this sort of "development" keeps up at the air-races, as it has done so consistently, then they'll be borrowing bombers and transport planes for next year's racing season. We are not so hot on this speed idea, as our readers well know, in fact we are ag'in it, but it is just one more proof that improvements do not come from races and this is our main contention and interest and has been for years.

As we said before, Major Doolittle ran up 252.69 m.p.h. in 1932 Thompson Trophy. In 1934, Col. Roscoe Turner slipped back a little with 248.19 m.p.h. But—in 1935—the noisiest year of the lot, in comes Neuman with only 220.194 m.p.h. to show for his trouble, or an exact 32.496 m.p.h. behind the 1932 record. But even this slow-down did not prevent one man from being killed and they nearly got Roscoe Turner into the bargain.

Just as a suggestion to our racing scientists, I propose that they take a few days off and look over a Lockheed "Electra," Boeing "299" bomber, a Douglas or some other big commercial or military plane and learn a little about



Seversky's Amphibion was entered.

—and so was an F3B-1 Boeing.

This is Whitman's Pobjoy racer.

Entered but not flown.

Benny Howard should smile—and how!

this speed thing. Such an inspection might lead to an epidemic of twin-motored or tri-motored racing planes next year since they can no longer tuck in sufficient h.p. in the nose of the racing planes and still have room enough for their feet.

But—here is one thing that sticks me. If the racing boys have been instrumental in developing all aviation, as they so raucously proclaim, then why the dickens is it that they are losing ground in speed, while in all other branches of aviation the speed of aircraft is notably picking up?

In any race, airplane, automobile or speed-boat, there are two factors that determine victory or loss. These are the effectiveness of the vehicle itself and, second, the personal factor of the driver or pilot. Therefore, it is sometimes a difficult matter to determine just who won the race—the plane, auto or boat or the man who won. To determine the actual merits of the machine, the personal factor must be eliminated so that a lab test is best of all.

It seems strange, doesn't it, that an inefficient vehicle like an automobile should do about 80 m.p.h. better than a special racing plane driven by a trained racing pilot? It seems that an engine does better with wheels attached at the front and rear corners than with wings sprouting out of its sides. But even at that, speed of vehicles of any sort has not increased so very rapidly.

Glenn Curtiss did a mile in 26.4 seconds on a motorcycle, so many years ago that the date has passed out of my memory and yet Sir Malcolm did his best mile in a fraction over 11 seconds. It has taken about 25 years, or more to accomplish this, the loss of many lives, tremendous expenditures of time and money, and what do we get from it? Only another race-meet with a gate admission attached and a dollar extra for cushions to sit on!

And here is another thing that does not seem to make good sense. There are a number of stock model automobiles on the market that carry a guarantee of 100 m.p.h. They are heavy sedans, coaches and coupes, turned out on the production line without more than a casual factory "final test" adjustment. And yet, specially built racing cars with special engines, tuned up to a gnat's eyelash and driven by expert drivers, can only show 105 m.p.h. on the Indianapolis Speedway! How come?

I am convinced that certain of the stock cars, with their heavy bodies and stock engines, can really do 100 m.p.h., or close to it, so that the trouble does not lie in that direction. I took one stock car (its name begins with "A" but they'll have to see the advertising manager if they wish me to mention the name here) over a measured mile in 38 seconds. This car was purchased at random in a local agency, was not tuned up and it still had a little soup left when I called it off and let up. And yet they only do 105 at Indianapolis on Memorial Day!

More News from the Plymacoupe

This is a rear view of the Plymacoupe with its parent, the Plymouth sedan in the offing.

A SMALL airplane, flying over Marshall, Mo., in a series of successful tests presaged the production of low-priced planes with standard automobile engines. A two-place, high-wing monoplane, the little ship was powered with a regular Plymouth engine, which performed perfectly as the plane went through its tests.

As the result of the tests, the United States Department of Commerce placed an order for another Plymouth-powered ship to be constructed immediately. The order was placed through the Amplex Division of Chrysler Motors.

The "Plymacoupe," as the plane is called, was built by the Nicholas-Beazley Airplane Co., Inc., of Marshall, Mo., which had been working with the idea for several years. President Russell Nicholas of the company said that the new ship will be priced much lower than the average plane on the market today. He pointed out that it also will offer lower maintenance and replacement costs because engine parts will be available at automobile dealers.

The plane is capable of a maximum speed of 120 miles an hour and a cruising speed of approximately 100 miles an hour. It has dual controls for instruction purposes.

"In our tests we have turned the crankshaft on the engine approximately 3,600 revolutions per minute," Mr. Nicholas said. "The gear ratio is two to one. This makes the propeller turn a maximum of 1,800 revolutions per minute."

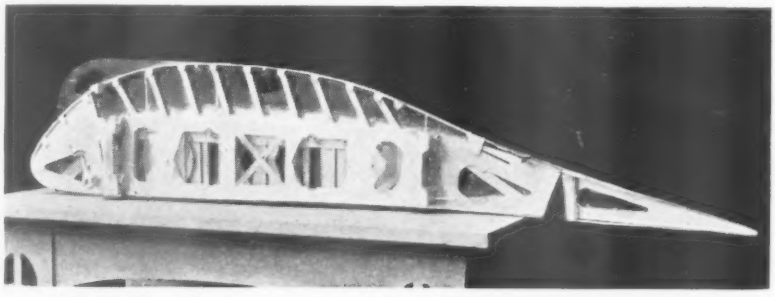
The plane weighs 1,078 pounds, minus gasoline, water and oil. It is equipped with a Plymouth instrument panel. The automobile instruments have been converted for aircraft use.

"The engine in the plane is a standard six-cylinder Plymouth motor, developed by Chrysler engineers," Mr. Nicholas said. "It was selected, after an investigation of other automobile engines, because of its favorable power-weight ratio. This engine has high pressure lubrication, a feature that keeps it in perfect operating condition at sustained high speeds and makes it particularly desirable for aircraft use."

A Novel Variable Camber Wing

WHEN the camber or depth of a wing section curve is increased, the lift of the wing is also increased. For many years, various attempts have been made at utilizing this principle to extend the speed range, deepening the camber at low or takeoff speeds and then reducing the curvature to permit of higher speeds with less resistance and power.

The inventor of the variable camber rib below, employs toggles to vary the upper curvature of the rib, thereby gaining the advantages of variable camber. Thus, when in full flight, the pilot flattens the curve. When landing or taking off, he deepens the curvature.



Showing the arrangement of the variable camber rib with toggles at the top.

The Cumulo-Nimbus Clouds

A further study into cumulus clouds with particular reference to the mechanism of the cumulus type known commonly as the "Thunder-Cloud." This cloud generates lightning and precipitates both rain and hail, all of which are hazards for the aviator.

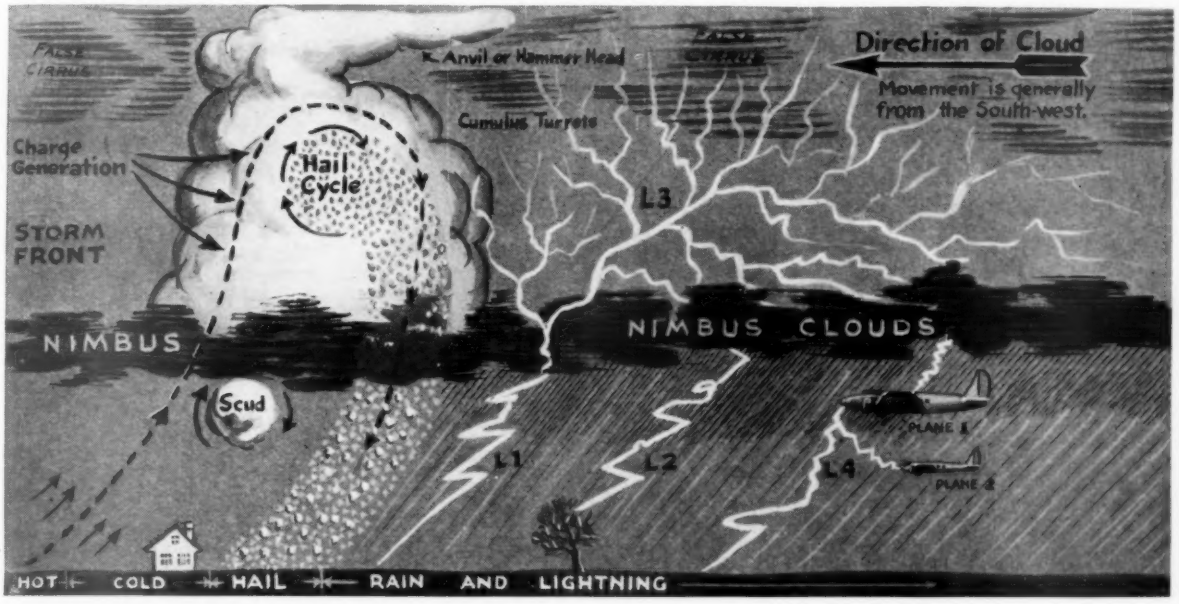


Fig. 1. The mechanism of the cumulo-nimbus or "Thunder-Cloud", showing how the cloud is formed, how lightning is generated and how hail is produced by the uplifting air currents at the storm front. Plane (1) is subject to damage while Plane (2) receives only a comparatively weak side-flash.

IN the last issue of P.A., we took a brief glance at the various varieties of cumulus clouds—those white glistening clouds that add so much to the beauty of the landscape and yet which often provide plenty of problems in flying.

We gave attention to, and made a few remarks concerning the cumulo-nimbus or "thunder-cloud" which provides frequent upheavals during the early summer months and occasionally during the winter. It is from this tumultuous combination of two cloud forms, the cumulus and nimbus classes, that we experience lightning, hail and violent downpours of rain together with a boiling air turbulence due to the vertical currents of air beneath the cloud.

Now, as a natural sequence, we will take up the cumulo-nimbus cloud in this article and give further details as to its performance, construction and reactions. From any standpoint, and particularly from an electrical point of view, the thunder-cloud is most interesting and complex—a veritable electric generator about which not a great deal has been written except in a fanciful way. Notwithstanding the conclusions arrived at by the various scientific and technical societies, the electrical storm is an ever present menace to aviation—or to all forms of transportation as a matter of fact, and while comparatively few disasters have been traced directly to lightning, other secondary disturbances have reaped their tithe of life and property.

Every year, the records show that about 500 lives are lost by lightning and an average of $6,000,000 worth of property is destroyed in the United States by lightning flashes. The loss is not great compared to auto accidents, nor when the tremendous number of lightning "shots" is considered, but nevertheless, the shot that does strike home is capable of a lot of damage. As the only available reports and records are largely those of insurance companies, it is evident that we hear only from insured property that is damaged and this is probably a comparatively small proportion of the total unreported damage. I believe that, if we would triple the damage given in the records, we would be closer to the truth, and still nearer if we included the damage due to the high winds and hail.

It is the commonly accepted belief that lightning and electricity are one and the same thing, but there is more than a doubt regarding this belief. This is not the place to enter into a long discussion on this subject, but in short, lightning does a lot of things that electricity does not do and conversely, electricity does a lot of things that lightning does not do. If lightning were wholly and completely electricity, then life would be impossible on this planet.

If lightning were totally electrical, then every stroke would be accompanied by a deluge of nitric acid and a tremendous wave of heat that would devastate several square miles of land. We know that this does not happen—even partly. Again, a flash of lightning powerfully illuminates the skies for miles and yet the light from an electrical arc with water electrodes is only faintly luminous. And so on.

But we do know positively that some sort of energy is discharged from the clouds to earth and, to avoid further controversies, we will call this discharge "lightning" and let it go at that. With this lightning flash comes a brilliant burst of light, sometimes white, sometimes red and sometimes blue. After the flash comes a report or crash that we call "thunder" which is the noise created by the flash. At points where the lightning strikes, the effect is more mechanical than electrical, objects may be shattered, torn or crushed rather than melted or oxidized. Trees are torn to pieces, rocks and brickwork are split and shattered and yet there is comparatively little evidence of heat—only sufficient in most cases to ignite dry wood, paper or similar materials of a highly combustible nature. At the best, a small mass of earth may be fused to form a glass-like follicle—so small that it can be held in one hand.

Of far more reaching danger is the

hail, the shrieking wind and the deluge of rain. These last three items are of more concern to the pilot than the lightning. With hail the size of hens' eggs slashing at the wing covering and denting the propellers, we can hardly expect a plane to safely escape the fury of such a storm when at the same time, tons of water are beating down on the wings and a howling wind endeavors to tear the plane to pieces.

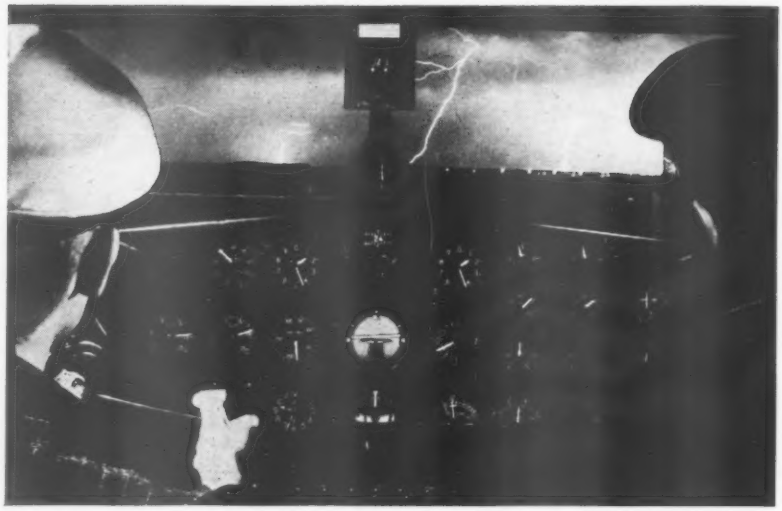
But now, to get back to the clouds that are the basis of this destruction, we see that they are built up of two distinct cloud forms, the towering brilliantly white peaks of cumulus (Thunder-head) and a lower thin sheet of jet-black ragged tumbling clouds known as the nimbus cloud that covers the underside of the cumulus. Thus, we have the term "cumulo-nimbus" applied to the thunder-cloud.

The towering white cumulus consists of fine ice particles suspended in the air by the violently uprushing vertical air-currents. The sun reflected from the ice facets gives this cloud its brilliant white color. Surrounding the cumulus peak is a haze of transparent cloud patches called "false cirrus" and which often precede a storm by several hours.

The low lying coal-black nimbus cloud consists of water-vapor and fine mist, because the altitude of this cloud is so low that its temperature is above the freezing point. Violent air disturbances give the nimbus its torn and ragged appearance, further affected by the precipitation of rain.

Rain falls from the nimbus clouds when they are cooled below their dew-point. Hail, in the form of solid ice pellets, descends from the upper cumulus clouds when they are caught in a down-coming current of air or when the upward air current is no longer moving fast enough to support them. The fine ice particles tumble about, descending as low as the nimbus where they are dampened and then whirled up again where they weld into other ice particles until a large lump of hail is formed which comes rushing down to earth with the rain. A lump of hail shows that it is built up of successive layers like an onion.

In Fig. 1 is a diagrammatic representation of thunderstorm mechanism. Warm moist air ascends from the ground at "hot" and rushes upward as indicated by the arrows until it reaches an altitude that is below the freezing point. The top of the cloud often has the fantastic "anvil" or "hammer-head" form shown



A rare view from the cockpit of a Lockheed transport plane flying into the teeth of a thunder-storm. From the tense attitude of the pilot, he must be experiencing bumpy weather. Photo by the courtesy of the Lockheed Airplane Company.

in the drawing. This is frequently 25,000 to 30,000 feet above sea-level so that few planes can fly over it. It is better to fly around rather than over the storm. Here, the moisture freezes into fine ice particles, creating the white cumulus crest. Some of these particles descend along the descending column of air until the increasing temperature causes them to melt, forming the black nimbus cloud that consists of mist and water vapor. If this down current is fast enough it will carry hail with it together with a deluge of rain from the nimbus cloud.

At "hot" where the up current starts, there is a sudden lull in the wind as it is blowing up and not horizontally. Immediately after comes the cold blast with the hail.

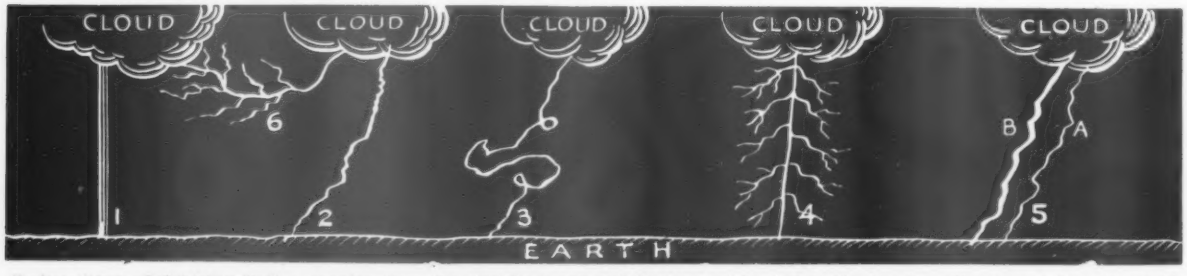
Caught between the up and down moving currents of air is a detached bit of nimbus cloud that rolls and tumbles near the front of the storm. This is the "rolling scud" or "squall cloud." Above it, at "hail cycle," is another rotation, this time of the cumulus cloud that welds the ice particles and causes hail.

The ascending air column is indicated as having a temperature of 90°F., while the descending current, coming from the high cool altitudes, may be as low as 50°F. or even lower. This explains the sudden blast of cold air that just precedes the downfall of rain. Thus, the people in the small house are first subjected to a 90°F. summer temperature and then are suddenly visited by the cold front blast, many degrees below the prevailing temperature. Just back of this air current comes the deluge of rain indicated by the slanting lines. Any attempt at flying under the cloud will end in disaster because of the violent vertical air currents and the hail. Probably only half or less than half the rain reaches the ground, the balance being returned by up-currents or evaporating.

The lightning is due to several reactions. First, the up-coming stream carries warm vapor with it which, upon condensing, greatly increases any charge that may have previously existed within the vapor. Second, the up-coming blast of air breaks up the water drops in the nimbus cloud into still smaller particles and the disruption of a water-drop produces a still higher charge. This charge now builds up rapidly with the countless drops of water until a sufficient potential is built up to ionize and break down the air between the cloud and earth, producing the brilliant flash that we call "lightning." This discharge, taking place from the clouds to earth is shown at (L1).

At (L2), the lightning discharge has struck the tree (E) which happened to be located in the line of stress. This stroke exhibits all of the properties of a mechanical strain or tension that ap-

(*Continued on page 324*)



Various types of lightning flashes, ranging from the straight heavy rod discharge at the left to the tree formation second from the right. The discharge in every case takes place between the cloud and earth or from cloud to cloud.

Modern and Ancient "Tripods"

by

JOSEPH BRAATZ

FROM time to time, various stunt pilots have played the air-races and fairs with imitation "tripod" pushers, that have been heralded as the "oldest planes in America." After making this announcement, the pilots then proceeded to do funny tricks with the socalled replicas, much to the detriment of the old-timers' reputation.

Very recently, another tripod pusher has been making the rounds, claimed to be an original Curtiss pusher of 1910. That this latest creation in no way resembles the old genuine 1910 plane can be seen by comparing Figs. 1—2. The only point of resemblance is in the fact that both are pusher biplanes with a three-wheel landing-gear.

A glance at Fig. 1 will show that the plane now flying has thick double covered wings. The original 1910 Curtiss had single covered wings with the fabric attached to the bottom of the ribs. Second, the original Curtiss controls were entirely different, shoulder control being used for the ailerons in the old 1910 ship while stick control is used with the modern version.

A glance at the chassis or landing gear shows a further remarkable difference. The ship in Fig. 1 has a complicated steel tube landing gear while the 1910 Curtiss ship (Fig. 2), was a simple wood affair that in no way corresponds with the gear in Fig. 1. And then, look at the engine mounts and compare them. Evidently the present operator is afraid of the engine falling on his neck. The struts and booms are obviously of steel tube in Fig. 1 while spruce and bamboo were used in Fig. 2.

The old time plane was innocent of the shock absorbers used on the new ship, and the oldtimer in Fig. 2 employs interplane ailerons instead of the conventional trailing edge flaps of Fig. 1.

All this sort of monkey business gives the oldtimers a pain in the neck, particularly when the pilot tries to make the ship wabble all over the field as the original never did. The genuine 1910 Curtiss Tripods did fly very nicely with their little 35 h.p. engines, and as shown in Fig. 2, it was possible to carry the weight of an additional passenger which was a real feat with the small amount of power available.

In the lower picture Fig. 3, are shown four naval officers with Glenn Curtiss. These were aviation notables in their day, Lt. Paul Beck, Lt. Walker, Lt. Kelly, and Lt. Ellyson. It will be noted in this picture that the single surface wing covering is attached to the top of the ribs, while the little four-cylinder kicker is shown at the rear.

Fig. 1. This is a modern version of the tripod that is not true to life.

Fig. 2. A true 1910 Curtiss Tripod with Glenn Curtiss in the seat.

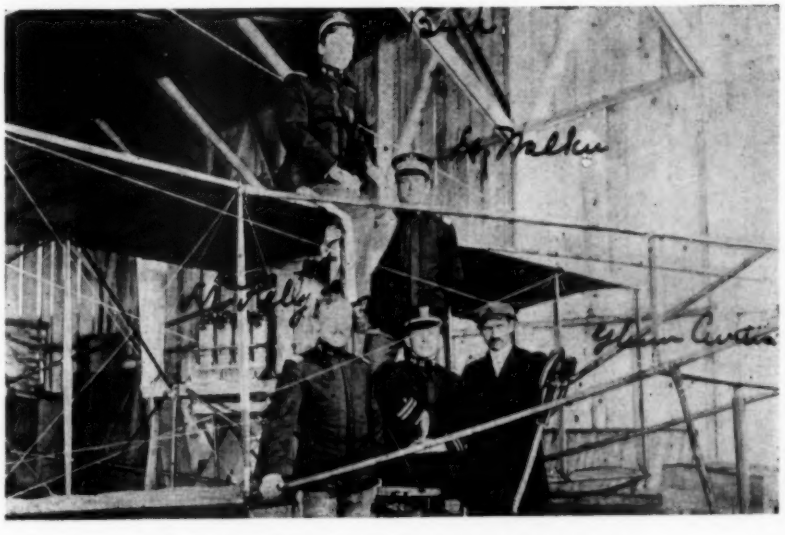


Fig. 3. Another picture of the old tripod taken in 1910.

XUM

Some Dope on the Boeing "299"

(See front cover)

The four-engined Boeing Bomber Type "299" which has put up a remarkable performance on test flights. She is so fast that pursuit planes don't mean a thing.

ON the cover of this issue and in the photo above, you will see the latest Boeing bomber, catalogued at present as the "299". It is appropriate that this numeral rhymes with "999", the symbol that for years has stood for speed and stamina.

It is whispered around that the four big motors pull this ship along at a speed in excess of 255 m.p.h., but the actual figure is not named. At any rate, even at an assumed minimum of 255 m.p.h. she is doing a whole lot better than the pylon polishers at the air-races, and can show the pursuit ships a cloud of dust and a disdainful tail.

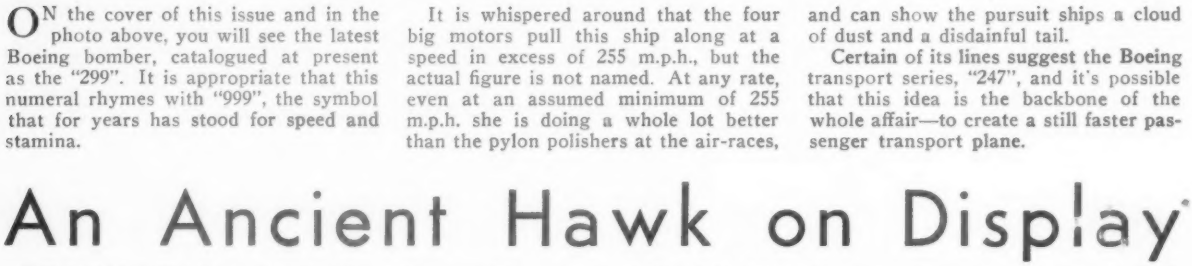
Certain of its lines suggest the Boeing transport series, "247", and it's possible that this idea is the backbone of the whole affair—to create a still faster passenger transport plane.

An Ancient Hawk on Display

AT Selfridge Field is a ship that has lived to an honored old age. It is the old original Curtiss Hawk, Type P1-A that was built near the year 1928. It is the progenitor of a large family of children, grand-children and great-grand-children, all of which bear the paternal name of "Hawk".

Its fabric hangs slack over its gaunt bones and its maneuverability ain't what it used to be, but just the same the old Curtiss P1-A wrote history in the U. S. Army Air Corps. And right in the nose is another old veteran, the Curtiss liquid-cooled D-12 engine that also wrote military history. We only hope that this old ship is assigned to a museum for future generations to ponder over. It sure was a wow in 1928.

They gave the P1-A plenty of stagger and a nice long lever arm for the tail-group. Then they hung the radiator under her nose like a chest 'chute and called her the "Hawk". May her tribe increase. This P1-A set a military fashion that is still in vogue, seven years after her first appearance.



This is the old Curtiss P1-A Hawk at Selfridge Field, the great grandfather of a series of "Hawks".

High-Lights and Side-Lights

by M. A. RODDY

Brief news notes on aviation activities and upon prominent personalities in aviation who are responsible for the progress of flying. Readers are invited to contribute news items to the author for publication in this department.

WELL sir, Congress has finished the first half of its perpetual game of aviation football with the companies leading. One of the dazed congressmen, coming out of the conferees' scrimmage, ran toward the wrong goal and before Congress realized it they passed the McKellar-Mead amended air mail bill which limits airline officials' salaries to $17,500 per annum.

It also vests broad regulatory powers over airmail contractors with the Interstate Commerce Commission, permitting variations of the payrate between the present 33 1/3 cents a mile, upward, to 40 cents absolute top.

The Postmaster General is also empowered by the bill to designate three primary routes across the continent with contractors being limited to one primary and three secondary routes. This will in no way affect United Air Lines, Seattle-San Diego run as this route has been termed "secondary", enabling United to keep both that and its northern transcontinental airway.

All [illegible] miles shall not exceed 45,000,000 [illegible] and contractors whose previous bids have been ruled unlawful are barred from further mail carrying.

Officials of the seven major transport companies, operating from Chicago, who carry 95 per cent of all the airmail flown in the United States, have expressed approval of the law as through its present provisions they will receive a retroactive bonus amounting to $700,000 and an annual pay increase of over $1,000,000 for flying mail.

* * *

FOR a time, it appeared as if the airmail legislation would be delayed until the next session as I am told Congressman Bertrand H. Snell was biding his time to press a minor technical objection based on the conferees report which, according to congressional law, would have delayed the bill had the objection been presented. Finally, the congressman went out to get a bowl of soup and during his absence the airmail bill was presented, passed and later signed by President Roosevelt which was duck soup for the sponsors of the bill but I don't know what kind of soup it was for Congressman Snell.

* * *

THE second half of this game of aviation football will be played when Senator Pat McCarran presents his measure which is to be for the permanent legislation of the air industry when it will come under the provisions of the President's plan for the coordinating of all forms of transportation.

WILL ROGERS and Wiley Post have made their last flight and the entire world mourns their loss and pays its tribute to their immortal memories. I would like to suggest through the columns of POPULAR AVIATION that a fitting monument might be the naming of some mountain peak along one of the transcontinental airways, the Rogers-Post Peak, and that there be a beacon placed upon it.

Every night, when Will's friends, the airline pilots, were winging their way home, Will's light would be shining to show them the safe way. Then, too, the maps of the world and the geographies of young America would show Rogers-Post Peak, symbolic of the peak that both men had reached during their human careers.

Radio now tells the mechanic just how tight machine parts fit together.

* * *

MANY moons ago, it was mentioned here that Mr. Eugene Vidal was under fire and that a certain subordinate was eyeing his job. Right now, in Washington, they are mentioning this subordinate's name out loud as being none other than Rex Martin, the present assistant director of the air bureau. Unless the fire subsides, Mr. Vidal may have to take to one of his $700 airplanes for an immediate flight to cooler, if not calmer regions.

* * *

MAJOR General Benjamin D. Foulois ended the bitter controversy between the War Department and the House Military Committee by his recent voluntary retirement from the service, effective December 22, on which date General Foulois will have completed a four-year term as chief of the air force with the rank of major general.

Following the airmail cancellations, General Foulois found himself to be more or less the goat of the situation and, during subsequent investigations, came under House fire concerning purchase of military planes.

When the House Military Subcommittee demanded that Secretary Dern remove him from his command, Dern refused the request and had the Inspector General of the army make a complete investigation which resulted in Dern clearing Foulois of charges of inefficiency and misstatements. This caused the House to then demand the Inspector General's report concerning the most colorful figure in American military aviation.

General Foulois was the first man to fly an airplane and a dirigible for the United States army. He was also the first chief of the air service of the A. E. F. in France, was the first commander to raid the enemy lines in France and was also the first officer to lead an air force into a foreign country when he accompanied General Pershing into Mexico in 1916.

General Foulois studied flying under the Wright brothers, the late Wilbur and Orville, who on August 19 of this year celebrated his 64th birthday at a lonely Canadian camp.

* * *

PRESIDENT Roosevelt awarded the Collier trophy for 1935 to Captain Albert F. Hegenberger (the first man to land a plane blind), for development of blind-landing safeguards which are to be installed in the near future by the Air Commerce Bureau at Washington, D. C., Newark, Pittsburgh, Indianapolis, Chicago, Kansas City, St. Louis, Cleveland and Columbus, Los Angeles, Oakland and Seattle.

Captain Hegenberger's device consists of two portable radio transmitters which mark the boundaries of the field. Shortly after the award, Captain Charles G. Williamson and Lieut. Edwin W. Virgin flew blind over the 400-mile hop from Hamilton Field at San Rafael, California, to Clover Field, Santa Monica, California, successfully concluding the longest blind flight ever undertaken by army aviators.

* * *

T. W. A. now has the first professional flying barber. The first man to receive an aerial shave was Chicago's City Aviation Chief, Walter Wright, which is as it should be for inasmuch as the Wright brothers were the first to fly there should also be a Wright to get

the first shave. Forced landings will probably be "close shaves."

* * *

POSTMASTER General Farley was in Hawaii when the Pan American clipper arrived on one of its record test flights, piloted by R. O. D. Sullivan.

I just wonder how the Postmaster felt when he saw this great airliner successfully completing another trail-blazing flight and realized that he had recommended a cut in the airmail rates as now being paid to Pan American.

Bids have been called for on a weekly air service across the Pacific from San Francisco to Canton, China, for a term of ten years with a maximum base pay of two dollars a mile for an 800 pound load with other specifications regarding bases, equipment and the like, which probably will result in Pan American receiving the contract.

Pan Am appears to be about the only company in a position to meet the post office requirements for this new ocean service which would be the 13th of foreign airmail contracts, but the Post Office Department evidently doesn't like the number "13," has scrapped it and classified this new contract as foreign airmail contract, Number 14.

* * *

CHICAGO is still building its island airport on blueprints, while Mayor LaGuardia of New York has begun another determined campaign to establish the eastern airmail terminus at Floyd Bennett Field and to this end has appointed Grover A. Whalen as chairman of a citizens' committee which will conduct a campaign among the business organizations to demand airmail service for Floyd Bennett Field. London and Jersey City are thinking of gigantic overhead airports.

* * *

AMELIA EARHART, who is now a grandmother as the result of a child being born to David E. Putnam, elder son of her husband by a former marriage, has resigned her dollar-a-year job as aeronautical expert for the Department of Commerce. When she was paid off she received 42 cents!

* * *

YOU may be interested to know that transport pilot John H. Hadigan is the owner of the old Curtiss biplane in which the late Charles K. Hamilton made his famous flight from New York to Philadelphia and return on June 13, 1910. According to Hadigan the plane is in storage and is registered and still flyable.

* * *

DENIAL has been made that Rear Admiral Richard E. Byrd is critically ill as a result of a gas poisoning suffered a year ago while studying antarctic weather during his long vigil 123 miles south of Little America. The Admiral has been out to Hollywood where he is editing the motion picture of his last polar expedition.

* * *

LAST March, the Air Ministry offered $125,000 to the British aircraft in-

(Concluded on page 337)

Starting a New Series of Cartoons

OUR READERS will welcome the new series of cartoons, "Strange as It May Seem", drawn by the celebrated cartoonist, John Hix and sponsored by United Air Lines.

First off, it is more than simply a series of cartoon strips. The many sketches give much information on little known and unusual subjects connected with aviation. Second, they are arranged to test the ingenuity of our readers—a sort of pictorial catechism, as one might say. And the answers to these problems will also be published in the same issue in case the reader has "given up" trying to get the answer. We're sure that you will enjoy this unusual feature.

The first of the series, shown below, is really self-explanatory and requires little further information than that on the face of the drawing. In the foreground we see the gentleman with the iron hat, standing in front of the old Franklin air-cooled car. He is earnestly regarding Cal Rogers flying the old Model "B" Wright biplane toward its distant goal. Cal, in turn, is probably wondering how much longer the propeller chains will stay on the sprockets or how much longer the bicycle nipple turnbuckles will resist stripping. Them were perilous days—believe you me.

"Strange as It May Seem", motor conditions are reversed. The automobile has an air-cooled engine while the Old "B" Wright has a water-cooled power plant. How things change. Notice how the "B" drags her tail.

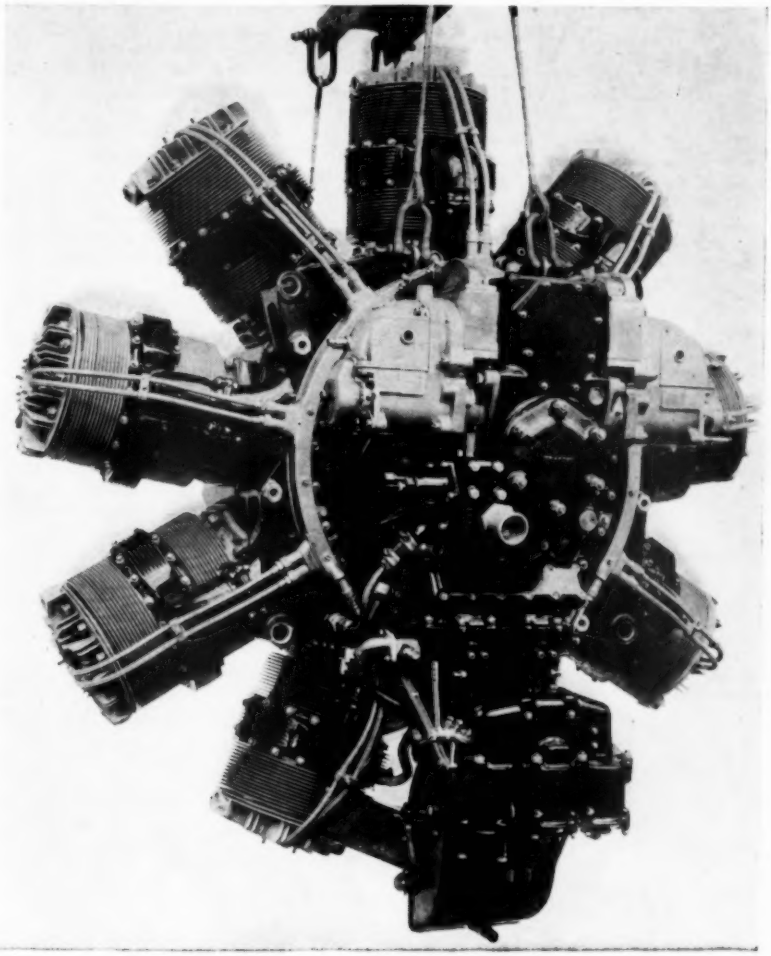
THE LARGEST CARGO OF LIVING CREATURES EVER CARRIED ON AN AIRPLANE WAS A SHIPMENT OF 20,000 "LADY BUGS" ON UNITED AIR LINES FROM SACRAMENTO TO NEW YORK.... THE INSECTS WERE BEING FLOWN TO FLORIDA TO COMBAT PARASITES IN CITRUS GROVES....
LAKE TAHOE IS IN THE STATE OF "CALVADA".... Half of it is in California and the other half in Nevada...
THE FIRST TRANSCONTINENTAL AIRPLANE FLIGHT WAS MADE IN 1911 BY CALBRAITH PERRY RODGERS - WHO FLEW ACROSS THE COUNTRY IN 50 DAYS....
TODAY UNITED AIR LINES' PLANES MAKE THE SAME JOURNEY IN 17 HOURS....
John Hix

This is the first of a series of cartoons by the celebrated cartoonist, John Hix, and is reproduced by the kind permission of United Air Lines.

British Sliding-Sleeve Engine

CONSIDERABLE interest is being taken in the new Bristol slide-sleeve engines by the aeronautic industry for the reason that the troublesome poppet valves are eliminated in this type and also for the reason that the slide sleeve arrangement permits of a cleaner external cylinder outline.

Sliding sleeves proved very successful in automobile engine practice and they will undoubtedly prove satisfactory in aviation engines. The Knight sliding sleeves employed in automobiles had an extraordinary long life.



The Bristol "Aquila" sliding-sleeve aviation engine viewed from the rear. Note the exceeding neat grouping of the accessories and the simple clean-cut cylinder outline, free from push-rods, rocker arms and similar obstructions to air-flow.

SLIDE-sleeves, probably suggested by the Knight automobile engine, have been applied to aviation engines by the Bristol Motor Company, Bristol, England.

These new Bristol engines, known as the "Aquila" and the "Perseus" slide-sleeve engines, have cylinder capacities of 15.6 liters and 24.8 liters respectively. It has been demonstrated, conclusively, that excellent fuel consumption can be obtained with valves of this type and that higher compression ratios with a given octane value are also possible. It should be noted that the valves in the Bristol engines are single sleeves instead of the double sleeve type employed in the Knight engines, and are therefore simpler and cheaper to manufacture than the Knight type.

Instead of using the conventional spring-loaded poppet-valves, the sleeve-valves employed are thin hollow cylinders that slide inside the main cylinder, opening and closing the intake and exhaust ports at the proper time in relation to the movement of the piston.

The action is smooth and without shock or impact stresses and without the necessity for using springs, cams, or other trouble making parts. This type of valve permits of a symmetrical simple cylinder outline to which cowlings and baffles can be fitted simply and efficiently without contending with rocker arms, valve pockets and similar irregularities.

The engines, now presented, are for civil aviation and are not yet available for military planes. The official tests have been completed satisfactorily on the "Aquila" and "Perseus" but not on the military types which are still in the development stage. It is to be believed, however, that the slide-sleeve type will fill an important place in military aviation where the outstanding demand is for a simple and reliable engine of a compact type.

Poppet valves require grinding at frequent intervals and there is always a possible chance of broken valve springs, sticking valves, burned valve-seats and similar troubles which are absent in the sliding-sleeve engine. In the case of the sliding-sleeve valve, the action improves with age, becoming a better and tighter fit after running for a time than when new. The valve areas are larger with a given valve movement with less loss due to gas friction.

This application of sliding valves to aviation engines is not entirely new for the Panhard company in France and the Daimler Works both experimented with Knight sliding-sleeves many years ago, but found them too heavy due to the fact that double sleeves were necessary in this case. Again, the double sleeves were difficult to manufacture and assemble due to the fact that they were very thin and subject to distortion when removed from the cylinder for cleaning or adjustment. This difficulty is overcome with a single sleeve type which can be made more rugged.

The rear covers of the engines have been carefully laid out to obtain the neatest and most compact arrangement possible for the accessories on the back of the engine. The accessories compromise a fuel pump, air-compressor, electric generator and the engine starting gear. The new type carbureter is fitted with automatic altitude and boost controls and with a hot and cold air intake.

A very simple but strong four-point mounting is provided for the "Aquila" engine, and in the case of the larger "Perseus" engine, the mounting is interchangeable with that of the Mercury and Pegasus Bristol engines. This is a great advantage where the older engines are to be replaced with the new slide-sleeve.

A Hamilton two-position controllable pitch propeller is standardized for both engines. An oil-control valve is incorporated into the housing which is linked to the reduction gear casing, and is operated by an Arens cable. By means of the valve, the oil pressure from the lubricating system is utilized for the operation of the adjustable pitch mechanisms.

The first units of this type delivered

for actual commercial operation, were four "Perseus-II-L" engines purchased by the Air Ministry and issued on loan for installation in the Imperial Airways plane, the "Syrinx". This ship is a four-engined Short transport plane originally equipped with four Jupiter X.F.B.M. poppet valve engines.

To make a comparison between the poppet-valve and slide-valve engines, two of the original poppet-valve Jupiters were removed and replaced by two slide-sleeve Perseus engines, the ship being propelled on the trial trip with a combination of two slide-sleeve and two poppet-valve engines. The "Syrinx" was then put into regular passenger service between London and Paris so that the test was made under actual operating conditions.

At the end of 317 hours and 292 hours, respectively, the two Perseus engines were removed and returned to the Bristol works for a complete dismantling and inspection. And, as this was the first opportunity for an inspection of a slide-sleeve engine after actual commercial service, the inspection was more careful and critical than usual.

To the satisfaction of the inspectors, all of the items were found to be in excellent condition. The sleeves were not scored nor scuffed, the junkheads were in good condition, the carbon deposits were thin and easily removed and the pistons were not scored. The "junkheads", be it understood, are the cylinderhead extensions that seal the upper ends of the sleeves.

With the combination of two Perseus and two Jupiter engines, the cruising speed of the "Syrinx" was increased by 8 m.p.h., and the fuel consumption was materially reduced, below the consumption of the four Jupiter engines alone. The condition of the engines after the tests was such that there will be a longer running time between top overhauls in future operation.

Much better fuel economy is expected after the engines are fully "run in", and when the four Perseus engines are installed instead of the combination made with the Jupiter engines. During the tests, the best economy could not be obtained owing to the conflicting cruising speeds of the two types of engines.

Better performance with a slide-sleeve engine is due to a number of factors, not the least of which is the greater gas areas through the slide-valves which prmit of freer exhaust and a better volumetric efficiency due to the wider opening of the intake. Again, the sliding-sleeves are tighter and improve in this respect as the engine runs in, thus maintaining the desired compression pressure for long periods. Poppet valves, on the contrary, warp, burn or peen-out so that they must be reground frequently to maintain gas-tightness.

The Bristol "Perseus" sliding-sleeve valve engine viewed from the front. Note that the exhaust ports are placed in the center of the cylinder length and that external valve operating mechanism is entirely lacking.

Airplanes Are Now In the Rice Fields

This plane is sowing rice, guided by the flag held at the beginning of the next row.

RICE GROWERS in the southern states find that the airplane is a very effective seeding machine. It spreads the seed rice uniformly over the submerged earth where other forms of vehicles are hindered by the water and mud.

In the picture above, we see a plane hard at work over the rice marshes, sowing rice under the direction of the flagman on the ground.

More About the Flying Louse

SKY-LICE are sprinkled all over Europe, Asia and Africa, according to the latest dope from the other side. Monsieur Henri Mignet has made various demonstrations of his pet in Europe and England, which demonstrations included a flight from St. Inglevert, England, to Lympne in 52 minutes, with the original Pou du Ciel.

The first fatal accident in a Sky-Louse occurred at Algiers. It went into a spin at about 100 feet and killed the pilot Marignan. It is said that about 40 Sky-Lice have been built in Algeria.

We still cannot reconcile ourselves to the tandem monoplane idea, and frankly we do not see what all this fuss is about when more conventional types of lightplanes are giving every satisfaction. If the Sky-Louse of Mignet had any striking advantages over the ordinary monoplane and biplane we could account for the tremendous interest shown, but so far there seems to be no particular advantage in this construction and nobody, so far as we have heard, has been able to fly it successfully except Mignet.

Except as a novel experiment for those who wish to experiment with the unknown, we can hardly recommend it to our readers until the echoes of the crashing die away. England has been particularly unfortunate with the Pou du Ciel and, if they can't built it in England in such a way that it can fly, there is little use side-tracking our own well developed lightplanes for this—to say the least—peculiar contraption.

The World's Planes and Builders

In the following tabulation will be found the principal airplane builders of each country, their addresses, the name and type of planes built and the symbols adopted for these planes. We wish to acknowledge assistance from Jane's *All the World's Aircraft* in making this compilation. This issue lists the builders and planes alphabetically by countries up to and including France. The listing will be completed in our next issue.

MANUFACTURER	PLANE SYMBOLS	DESCRIPTION
ARGENTINE REPUBLIC		
Military Aircraft Factory, Cordoba.	Ae.C.1.	3-seat plane.
	Ae.C.2.	2-seat training monoplane.
	Ae.C.3.	2-seat light training monoplane.
	Ae.M.O.1.	2-seat military training monoplane.
	Ae.T.1.	5-passenger cabin monoplane.
AUSTRALIA		
The Cockatoo Dockyard & Engineering Co., Ltd., Cockatoo Island, Sydney, N. S. W.	Codock.	6-passenger monoplane.
Larkin Aircraft Supply Co., Ltd., Melbourne Aerodrome, Melbourne, Victoria.	Lascoter.	1-engine monoplane.
	Lasconder.	3-engine commercial monoplane.
AUSTRIA		
Th. Hopfner, Flugzeugbau, Stubenring 16, Vienna.	Hopfner HS-1033.	3-seat cabin lightplane.
	Hopfner HA-1133.	4-seat twin-engine amphibian.
Ramor Flugzeugwerke, Gratz.	The Ramor KE-14.	4-seat light cabin monoplane.
BELGIUM		
Societe Anonyme Avions Fairey, Gosselies. (Branch of Fairey Aviation Co., Ltd., Hayes, Middlesex, Eng.)	Firefly.	1-seat fighter.
	Fox.	2-seat day bomber.
Establissement Jef Guldentops, 21-35, Rue H. Van Nerom, Evere, Brussels.	The Guldentops.	2-seat sporting monoplane.
Les Ateliers De Constructions Aeronautiques Belges, 22, Rue Saint-Georges, Brussels.	L.A.C.A.B. T.7.	Single-bay staggered training biplane.
Ateliers de Constructions Aeronautiques de St. Hubert, Saint-Hubert.	Orta-Saint-Hubert.	2-seat light monoplane.
Constructions Aeronautiques G. Renard, 58, Rue Henri Wafelaerts, Brussels.	Renard R-31.	2-seat observation monoplane.
	Renard 33.	2-seat training monoplane.
J. Stampe Et M. Vertongen, Deurne-Sud, Antwerp.	Stampe-Et-Vertongen S.V.4.	2-seat light training biplane.
	Stampe-Et-Vertongen S.V.5.	2-seat military training biplane.
	Stampe-Et-Vertongen S.V.7.	2-seat bombing and observation biplane.
	Stampe-Et-Vertongen S.V.22-LYNX.	2-seat advanced training biplane.
	Stampe-Et-Vertongen S.V.26-LYNX.	2-seat training biplane.

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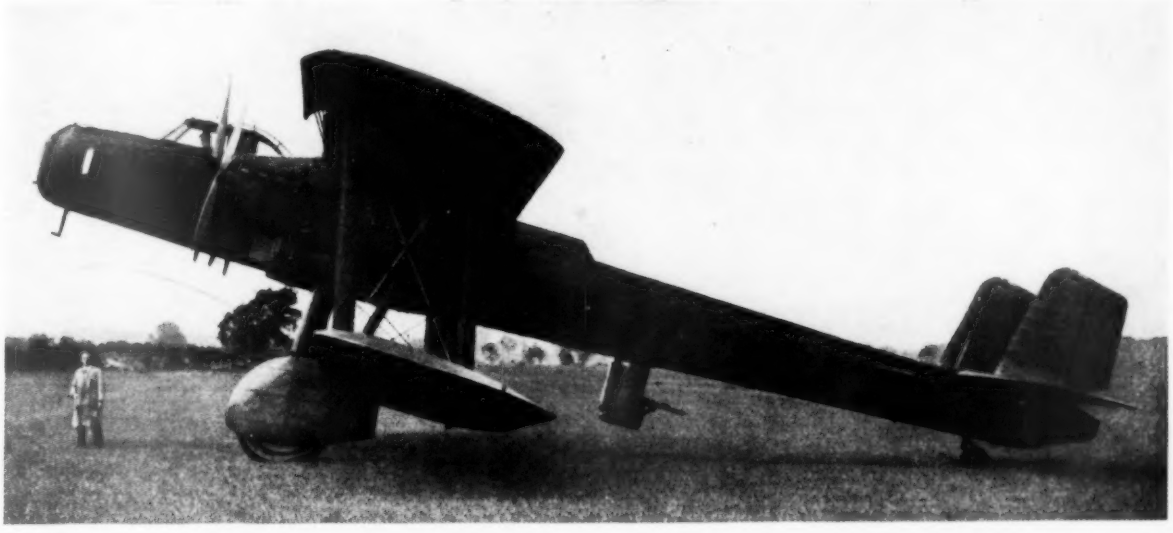


The Mark II Handley Page "Heyford Express" Bomber, one of the largest and most successful English bomber types. It was the first bomber to employ the "dust-bin" type of gunner's turret and to elevate the fuselage to the level of the top wing.

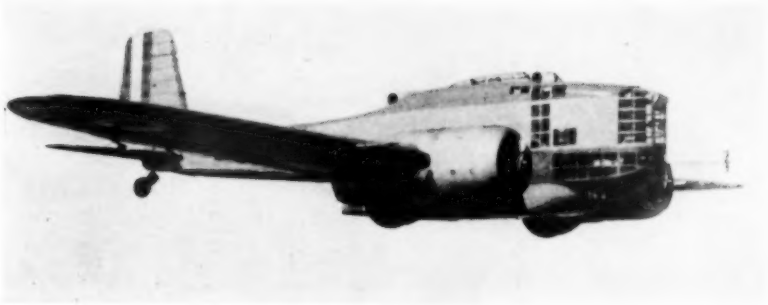
XUM

MANUFACTURER	PLANE SYMBOLS	DESCRIPTION
BULGARIA		
Darjavna Aeroplanna Rabotilnitza, Bojourishte Aerodrome, Sofia.	D.A.R. 4.	4-passenger cabin biplane.
	D.A.R. 6.	4-seat training biplane.
CANADA		
The Ottawa Car Manufacturing Co., Ltd., Ottawa.	Avro.	Training planes.
Canadian Vickers, Limited, Montreal, Quebec.	Canadian Vickers "Vedette VI".	3-seat flying-boat.
	Canadian Vickers "Vancouver II".	2-engined flying-boat.
	Canadian Vickers "Vancouver IIA".	Modification of the original "Vancouver".
Fairchild Aircraft, Ltd., Longueuil, Montreal, P. Q.	Fairchild Super-71.	9-seat cabin monoplane.
	Fairchild 71-C.	7-seat cabin monoplane, for transport, mail, photography and general commercial use.
	Fairchild 71-CM.	A metal fuselage skin has been fitted to 71-C. In all other respects the 71-CM is identical to 71-C.
CHINA		
The Naval Air Establishment, Shanghai.	The "Nin Hia" Shipplane.	Single-seat observation seaplane.
	The "Chiang Hau" Landplane and Seaplane.	2-seat advanced training biplane.
CZECHOSLOVAKIA		
Aero Tovarna Letadel, Praha-Vysocany.	Aero A-46.	2-seat military training machine.
	Aero 100.	2-seat general-purposes military biplane.
	Aero 200.	4-seat lightplane.
Avia, Prague-Cakovice.	Avia 34.	1-seat fighter biplane.
	Avia 534/11.	1-seat fighter biplane.
	Avia 122.	1-seat advanced training biplane.
Vokenska Tovarna Na Letadla, Praze, Praha-Letnany.	Letov S-231-2.	1-seat multi-gun fighter.
	Letov S-328 and S-428.	1-engine 2-seat high-performance military biplane.
Ceskomoravska-Kolben-Danek, Prague VIII-Liben.	Letov S-39.	2-seat light monoplane.
	Praga B.H. 39.	2-seat primary training biplane.
	Praga B.H. 41.	2-seat advanced training biplane.
	Praga E. 44.	1-seat fighter biplane.
	Praga E. 36.	2-seat general purpose military biplane.
DENMARK		
The Royal Army Aircraft Factory, Kovermarksvej, Copenhagen S.	Fokker C.V.E.	2-seat observation biplane.
The Royal Naval Dockyard (Orlogsvaerftet), Copenhagen.	H.M. II Seaplane.	3-seat observation seaplane.
ENGLAND		
Airspeed, Ltd., The Airport, Portsmouth, Hants.	Airspeed "Courier".	1-engine freight or passenger monoplane.
	Airspeed "Envoy".	2-engine passenger or freight monoplane.
	Airspeed "Viceroy".	2-engine long-range monoplane.
Sir W. G. Armstrong Whitworth Aircraft, Ltd., Coventry.	Armstrong Whitworth A.W. 19.	General purpose bombing biplane.
	Armstrong Whitworth A.W. 35 "Scimitar".	1-seat fighter.
	Armstrong Whitworth A.W. 15 "Atalanta".	Commercial monoplane designed for tropical service.

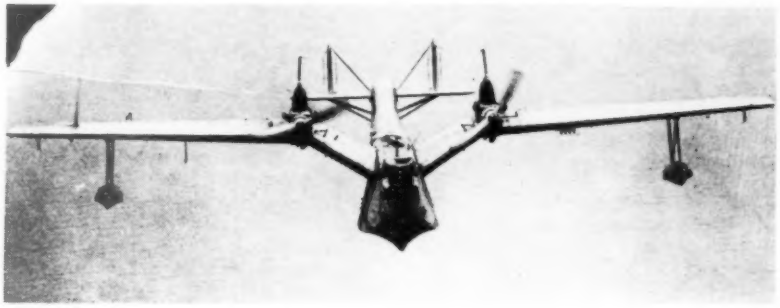
(*Continued on page 326*)

This is the giant Soviet plane, "Urss No. 25" with which Sigismund Levanevski, the noted Russian pilot will make a second attempt to fly to San Francisco by the way of the North Pole.

Four Recent European Planes

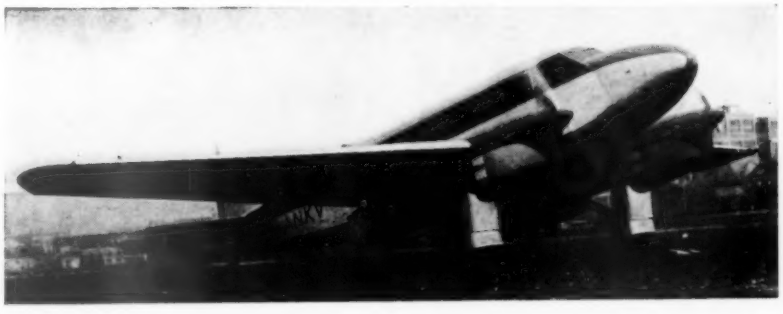


AT RIGHT. The Breguet "460" bomber is a cantilever type low-wing monoplane employing two Gnome-Rhone KRSD engines developing 825 horsepower each at 13,120 feet elevation. The test flight from Paris to Madrid, Spain, was made at a cruising speed of 212 miles per hour. The absolute ceiling is 36,000 feet. The fully loaded weight is 16,450 pounds.



AT LEFT. The Short flying-boat, type "R-24/31", is appropriately called "England's Ugly Duckling". An abrupt fractional dihedral angle is given to the wing with an engine at the apex of the angle, this arrangement giving the boat better stability. Note its similarity to the wing tried out by Les Long, described and shown in this issue.

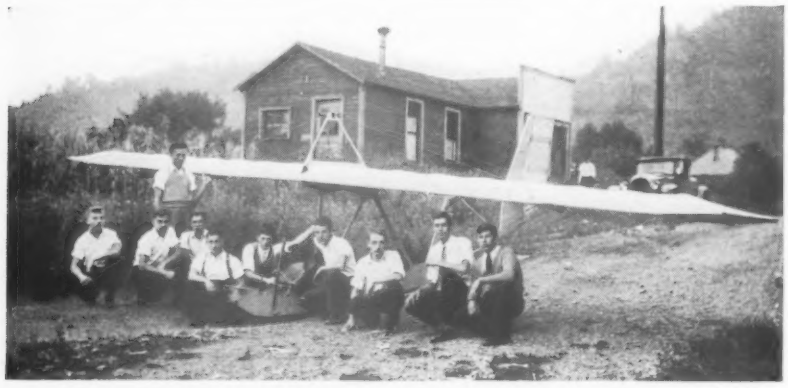
AT RIGHT. This is an English Bristol Type 120 General purpose plane equipped with a Bristol Pegasus radial air-cooled engine. This plane performs variously as a fighter, bomber, photographic plane, ambulance or general utility craft. The cage provided for the observer in the rear cockpit is of original design and affords a wide visual range.



AT LEFT. The Caudron C.440 transport plane, known as the "Goeland" or "gull-type", is an 8-seated passenger plane that is to be used on the routes of the Air France. Equipped with two Renault 212 horsepower air-cooled engines, it has a top speed of 200 miles per hour and a radius of 1,250 miles when fully loaded to a weight of 7,275 pounds.

The Activities of Our Aviation Clubs

We solicit news from flying clubs of every kind, flying clubs, ground clubs, technical organizations, glider clubs and every sort of club based on aviation. Send in the story of your club.



Members of the Mountaineer Aeronautical Club, McMechen, W. Va., with their primary glider. This club was organized in 1930 and has twelve active members.

THERE are clubs and clubs devoted to aviation and letters from them are pouring into this office. Just keep the good work going, and send in all the dope you have on hand regarding your club or any other aviation club with which you may be familiar.

First, on the pile of letters, is a letter from the Atoka Aviation Club of Atoka, Oklahoma. This letter, written by Erl Baxter, tells of the aviation activities in his town and gives us a lot of dope on the club itself.

The Atoka Aviation Club now has a membership of fourteen with an ultimate membership objective of twenty-five. It is making plans for building a hangar at the local airport which, by the way, is said to be one of the finest airports in Oklahoma. The members also intend to promote an air-circus in the near future and the Chamber of Commerce has pledged their support to this undertaking.

The F.E.R.A. director, according to the president of the club, has promised to finance the new hangar project whereby all of the labor and twenty percent. of the material will be supplied for the hangar. The local theater has also promised to assist the club in raising the remainder of the money.

The officers of the Atoka Aviation Club are: Earl H. Barrett, President; Bobby Cates, Sec'y-Treas.; Earl Baxter, Reporter; Rev. Harvey Cody, Chairman of By-Laws Committee.

* * *

THE Cambridge Flying Club, Cambridge, Mass., was organized several months ago by a group of young Cambridge men, according to the chairman of the Executive Board, James Herlihy. The Chairman is, in effect, the president of the club under its plan of organization.

Regular weekly meetings are held every Tuesday evening in the Cambridge Public Library. Lectures are given at these meetings together with the usual discussions. The club is in the market for an Aeronca at a reasonable price for the use of the members in training and running up time. It makes no difference whether the plane is in need of overhaul because the club has facilities for making repairs. If any of our readers have such a ship to offer, please get into touch with Mr. Herlihy.

(Concluded on page 322)

Students of the Ryan School of Aeronautics, congratulating a former student on his record breaking flight.

STATE AVIATION DEVELOPMENTS

IN some states there has been considerable antagonism by pilots and plane owners towards state control of aviation by various boards, commissions, or other regulatory bodies.

Some of these groups have been empowered by their respective legislatures or assemblies to enforce regulations which seem unfair and to collect fees which appear excessive with no returns being received from them. However, there are several states which have done creditable work in the regulation and promotion of aeronautics. Notable among these are Connecticut, Florida, Illinois, Michigan and Ohio. Air marking is the project which is perhaps more universally carried out than any other by the various states.

Connecticut, with its several hundred signs, has been complimented in various ways for this phase of its promotional activities. During the early part of 1934, the U. S. Department of Commerce sent a bulletin to all of the states in which the air marking program of Connecticut was detailed. A recommendation was made that other states take advantage of the experience gained by this eastern state.

Included in the bulletin were the suggestions that: (1) Boy Scouts be given the opportunity to construct signs and (2) stencil sets be used to reduce the time and expense of painting signs. Permission has been obtained from the Highway Department to erect roadside markers and highway directional information near towns. One of the large oil companies (The Texas Company) approved the use of their oil tanks for air marking signs. A railroad operating through the state has allowed the use of every station roof. When the Federal government was notified of this idea similar permission was received from many of the rail systems throughout the country.

In addition to the air marking projects, the Department of Aeronautics, under the direction of Charles L. Morris, operates two state-owned aircraft, a Stinson cabin and a Travel Air open cockpit biplane. These planes are equipped with high-frequency transmitters and receivers, which are useful in aiding forest patrol, police and other state organizations.

The Connecticut State Trade School, at Putnam, was the first school of its type in the United States to be issued an approved aircraft repair station certificate by the U. S. Department of Commerce. Florida, under the leadership of Major A. B. McMullen, director of the Aviation Division of the State Road Department, has proposed a 10-year plan of aviation development, which is undoubtedly the most comprehensive program of any state in the Union.

An expression of appreciation in the form of a resolution, passed by a unanimous vote by their House of Representatives was extended to the Major for his untiring efforts. The extensive

(Concluded on page 320)

Fuel Injection Problem Solved

by

S. R. WINTERS

BECAUSE of the limits placed upon detonation by a limiting octane value of fuels, injection type engines are receiving a great deal of attention. This latest experiment with the injection system is of interest to all engine men.

AFTER intensive research toward final perfection, the U. S. Army Air Corps recently announced adoption of fuel injection to supplant the carburetion system in Army airplanes.

With the advent of high-speed compression-ignition engines in aviation, the use of direct injection from the fuel pump became necessary to feed essentially minute quantities of liquid fuel into the combustion chamber of the engine during extremely short-time intervals.

Whereas, the mechanically-operated injection valve had proved satisfactory for slow-speed engines, the amount of fuel injected was insufficient for higher speeds, chiefly because of the difficulty experienced in keeping the lift adjusted properly while in operation.

Knowing the float mechanism to be largely responsible for unsatisfactory performance obtained with carbureters during execution of tactical maneuvers, preliminary studies were made employing carbureter bodies, throttles and discharge nozzles, but with metering controlled by some device which would not change its characteristics while engaged in these operations.

Many problems arose that seemed impossible of solution and they were removed only with the expenditure of much concentration and experimentation, as no precedent of experience along parallel lines existed. Had these problems not arisen, it is certain that our knowledge of fuel injection and its application at this date would be far less.

This Wasp is equipped with a Marvel fuel injection system described in this article. Essentially it is a low-compression Diesel engine.

The different types of fuel pumps that have been employed are numerous but, in general, they may be divided into two main classes: Pumps in which the fuel quantity delivered is controlled by the stroke, and pumps in which fuel delivery is governed by valves that by-pass the material for a certain part of the stroke.

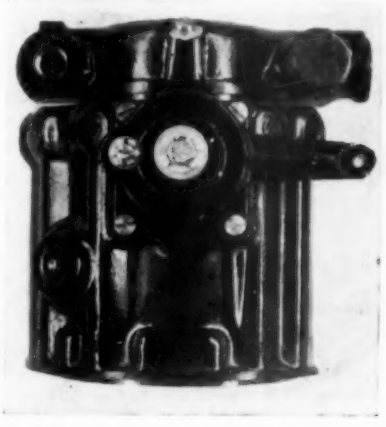
With those of the first class, either a lever arm of variable length, or a bevel-flank cam may be employed. With the constant-stroke pump the by-pass valves may be port or poppet valves, or a combination of a poppet and a needle valve.

Two other types of pumps may also be mentioned: A variable-stroke type in which the fuel quantity delivered is controlled by a valve that by-passes part of the fuel during the injection stroke; and a constant-stroke pump in which the fuel quantity is regulated by limiting the fuel drawn into the pump on the suction stroke.

Ensuing tests disclosed that a positive displacement, piston-type pump with means for adjusting the stroke possessed characteristics basically correct for aircraft engines. Numerous devices and methods for obtaining variation in the stroke of the piston-design pump involving linkage, cams, etc., were considered. A wobble plate with provision for controlling the angle of the plate was believed satisfactory and a piston type incorporating this feature was designed and constructed by the Air Corps.

Installation was then made on an engine equipped with rotary induction system, no attempt being made to synchronize the pump discharges with the suction impulses from the cylinders, the drive being taken from the accessory section at the rear of the motor. While

Top view of the Marvel fuel injector as applied to aviation engines.



Side view of the Marvel fuel injector.

distribution was better than with the carbureter, it was conceded that better apportionment of fuel could be accomplished if the fuel was introduced near the intake port of each cylinder.

A variable-stroke piston-type injector of the basic design, invented by M. G. Chandler, was then built and furnished to the Air Corps by the Marvel Carburetor Company and was used in studying nozzle arrangements for injecting fuel into the intake port of a single-cylinder engine. These studies revealed that such induction by means of a spring-loaded nozzle with the discharge phased with air flowing to the cylinder on the suction stroke was readily accomplished.

Fuel consumption and power compared favorably with the best results obtained through use of carburetion, under directly comparable conditions. Bench tests conducted with this injector indicated that the design was basically correct but that the performance needed to be materially improved. The nozzle proved unsatisfactory mainly because the cut-off was not definite and fuel was delivered inconsistently throughout the entire engine cycle.

Subsequent experiments with nozzles employing spring loaded spindles or valves disclosed that the natural period of the spring and related assembly was such that in parts of the operating range this cycle coincided with the pulsations in the fuel-feed tube and caused fuel to discharge, out of phase with respect to the air-stream moving to the cylinder. Also no design could be perfected which would keep fuel from pocketing or collecting on the nozzle body.

Continued efforts were then concentrated upon the development of fuel injectors following the basic design, for multi-cylinder engines, as well as in developing a satisfactory discharge nozzle for injection into the induction system. From various trials, an injector was designed which furnished performance within 2.5 per cent of the theoretical and withstood a 1,000-hour endurance test without change of characteristics.

In this injector the volumetric delivery was directly proportional to speed and to stroke lever setting and the discharge terminated at the same angular position regardless of either, with the period of delivery becoming shorter as the stroke was reduced. These fundamental qualities proving correct for induction system injection in aircraft engines, later types became refinements of this injector to accomplish better installations on engines, eliminate vapor lock at high altitude whether due to volatile fuels, or to parts being bathed with hot lubricating oil, and for reduction of the force required for operation of the control.

J. F. Campbell, Chief of the Carbureter Unit, U. S. Army Air Corps, offers a comprehensive description of a modern fuel injector, as used in a 9-cylinder radial engine by his division. Quoting from Mr. Campbell: "This injector, including mounting bolts and gaskets, weighs 22 lbs., has a maximum diameter of 7 in., is 7⅝ in. long, is rated at 568

(*Continued on page* 319)

Waco Produces an Armed Model "D"

Three-quarters view of the Waco military Model D as supplied to the Republic of Cuba for use as an advanced trainer.

THE Waco Aircraft Company, Troy, Ohio, has just delivered an armed Model "D" Waco to the Republic of Cuba for use as an advanced trainer. Flyaway delivery was made from the factory at Troy, Ohio, to Havana, Cuba, in one day at an average cruising speed of 182 m.p.h.

This Waco carries two bomb-racks with a capacity for ten 25-pound fragmentation bombs. Three machine guns are fitted, one fixed gun in each of the lower wings and one flexible gun in the rear cockpit. Instruments are provided in each cockpit so that the ship can be used for training as well as in actual combat. In addition to this equipment, complete night flying equipment is provided, flares, landing lights and the necessary instruments.

The plane is powered with a Pratt & Whitney Model SB Wasp Junior of 400 horsepower and a Hamilton Standard fixed adjustable propeller is mounted on this engine. In many respects, it is a typical Model "D" Waco which has been described to some length in previous issues of POPULAR AVIATION.

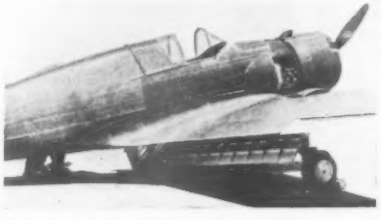
Officials of the Waco Aircraft Company say that the new ship is being kept busy in training officers for the Cuban air service and that the ship has met with an enthusiastic reception.

This type of ship has proved its rugged and enduring qualities in addition to putting up an excellent performance when employed under service conditions. Our readers will remember a somewhat similar Waco designed for the National Chinese Government some time ago.

Here Are the Curtiss Mystery "75" Snapshots

ONE of our readers in Buffalo, obtained this pair of snapshots aimed at the Curtiss Mystery "75" monoplane. Except for these photos, no further information is obtainable, but even without detailed specifications, the ship shows many interesting features.

First is the novel form of the retractable landing gear shown by the right-hand view. In the left-hand view we see evidence of a nice long flap on the trailing edge of the wing. The sudden increase in the fuselage taking place just behind the cockpit is also worthy of remark. We will await further views with interest.



Partial side-elevation of the Curtiss "75" showing wing-flaps.

Showing details of the retractable landing-gear on the Curtiss "75".

An Autogiro in the Antarctic

by W. S. McCORMICK

An interesting and instructive article on the servicing of an autogiro and the care necessary in extremely cold locations. The author was the pilot of the Kellett autogiro carried by the second Byrd Antarctic Expedition.

ON the way south the motor and autogiro units had to be prepared for flying in sub-zero weather. The motor was cowled and lagged in the usual manner. Each oil line was lagged with asbestos then taped and shellacked. An asbestos-lined metal box was made for the oil sumps. Each cylinder of the motor was cowled up to the combustion chamber and a special cowling was made to go over the opening around the crankcase.

In this manner all openings were covered so that most of the air flowing through the motor was stopped. A paste was made out of flake asbestos and water for the lower starter unit, this was put on and then covered with asbestos cloth, taped and shellacked.

There was also a special drain on the bottom of this unit so that after each flight all the oil could be drained from the system. The Marfax grease in the rotor head and upper starter unit was replaced with a combination of pyroil and regular heavy veedol grease. The Houdii oil in the dampers was replaced with straight pyroil.

There was no change in the landing gear struts. The rubber bumper blocks were left on the rotor head and they became very hard in the cold weather; however, the blades were not noticeably rougher.

After arriving at the Bay of Whales, the autogiro was rigged and flown from the Bay to Little America approximately seven miles away. The usual procedure was followed in revving up the blades. The skiis freeze to the snow which makes it very convenient in starting the blades. After about 110 rotor revs have been obtained the skiis break loose.

Before leaving the United States, the blades were flattened out one degree. This resulted in their turning somewhat faster and a somewhat longer run was required in take-off; however, a big advantage was landing in high winds. The highest wind in which the autogiro was flown was 20 to 25 m.p.h. Upon landing there was no hesitancy, that is, there was no tendency of the ship to balloon.

January, February and March 1934, approximately 7 hours were flown which was mostly local reconnaissance. The temperature during this time was from 30 below to 20 above zero Fahr. The most outstanding flight of this period was the location of the lost airplane. On that flight the autogiro carried an overload of 384 pounds with a tent strapped to the side and a sledge lashed underneath the fuselage. Terrain was bumpy and traversed by high sastrugi. Difficulty was found in turning the ship around after landing. The wind tended to make the ship weather-cock. During these flights the wind was 20 m.p.h.

The cold bleak wastes in Little America showing the Kellett autogiro in the center of the photo. It was under these difficult conditions that very successful flights were made.

William S. McCormick, the author, who was the autogiro pilot of the second Byrd Antarctic expedition.

During the winter nights, the blades and tail surfaces were removed and put in a tunnel under the wings of one of the airplanes. The tail was set up on a box so that the ship was in a flying position. A snow wall was constructed from the surface to the bottom of the fuselage and wings. The work on the motor was just the usual 20 hour check and no further work was needed. It was thought inadvisable to use rubber in the motor mount. Asbestos lining was installed before leaving the States, however, this was replaced by a regular rubber mount washer during this period.

In August, the blades and tail surfaces were installed on the autogiro in temperature of 60 to 67 degrees below zero. Specially constructed tents to go over the tail and around the rotor head so that heat could be applied before tightening up and safetying the various nuts and bolts and clevis pins were employed. The motor was started and the blades revved up and tested during a temperature of 62 degrees below zero and found to work satisfactorily and normally.

During the month of September, ten meteorological flights were made. The coldest temperature flown was 57 degrees below zero and the warmest was 41 degrees below zero. In preparing for flight in these sub-zero temperatures it would take from one and one-half hours to two hours to thaw the motor out sufficiently. Used two very powerful Van Praag blow torches inside the windproof tent. The front skiis of the autogiro were almost always about two feet under the surface so that it was approximately in a flying position and the controls and blades were individually secured to small planks of wood sunk four feet in the snow.

After the securing lines were all taken off and the snow shoveled from the skiis, the ramp shovelled to the surface and the motor started, it was necessary to keep it turning about 1,000 to 1,200 revs and to get in the air as quickly as possible otherwise the motor and oil would both cool off very rapidly which would mean possibility of motor failure during the take-off.

Due to the fact that the motor had to be run so fast to keep from cooling the clutch was not used in starting the

blades. Each take-off was a taxi off. The rotor head, upper starter unit and dampers were not heated prior to a flight. After the flight the autogiro was taxyed to the pit, oil drained, snow shovelled on the skiis, the blades and all the control surfaces secured so that in blizzards there would be no danger of its being blown away. In this manner the autogiro weathered temperature of 73 degrees below zero Fahr. and winds as high as 60 m.p.h.

On September 28th I taxiied down the barrier in the usual manner for a take-off on the tenth meteorological flight. Upon leaving the snow I knew there was something radically wrong. The nose of the ship wanted to go right straight up causing a whipstall.

With the motor wide open it took all of my strength to hold the stick as far forward as it would go, thus managing to keep from whipstalling. In this manner I struggled along until about 100 feet of altitude was obtained. At this point there was quite a strong wind which was very helpful in getting the nose down and turning around, then another turn for landing.

In the meantime it had begun clouding up as though getting ready for a blow. To get back to the surface I still had to keep the motor wide open and the stick all the way forward. In attempting to land the motor could not be slowed down at all because, as was said before, the ship would have been whipstalled. Nevertheless, when back to the surface the nose came up and nothing could be done about it. The result was a whipstall at about 100 feet.

Seeing that a crash was inevitable I cut the switch. The Giro fell off to the left landing on the left wing and tail. After investigating the crash the cause was due to the fact that snow had drifted in the tail end of the fuselage, resulting in the tail heaviness.

Up until the flight before September 17th, including three months operation the preceding Fall, there had been drifts with winds as high as 50 m.p.h. The Giro was on the surface during all this drift and had taken no snow inside at all.

In short, the flights under these extreme conditions demonstrated that the autogiro is fully as capable a ship as the airplane and that no new problems are introduced with the 'giro that do not occur equally with an airplane. As a matter of fact, no problems presented themselves that offered difficulties in their solution.

Very few planes would be capable of being anchored out in the open continuously with winds as high as 60 miles per hour without being damaged. This will be appreciated after an examination of the accompanying photograph where it will be seen that there is a very small amount of surface exposed to the wind in comparison to the great area of the wings of a plane. Even the small area of this 'giro with its clipped wings is greater than that of the new 'giro which has no wing surface at all.

The lubrication of the rotor head gave no trouble at all under the extremely low temperature of —73° F.

An Example of a Ford V-8 Installation

This photo shows a very compact and attractive mounting of a Ford V-8 engine in the nose of a tractor plane.

THE compact arrangement possible with a Ford V-8 engine is illustrated by the above photograph which shows the front end of an AV-8 designed by Neil McGaffey. The design follows very closely the design of the automobile hood from which the engine was taken.

This engine propels the plane at a top speed of 115 m.p.h. and is very economical and easy to maintain. Automobile gas and automobile engine lubricants are used so that the fuel problem is not of much importance. Replacement parts can be obtained.

Components of the Lear Radio Compass

THE Lear Radio Compass, specially designed for privately owned and small commercial planes, is a very compact apparatus that is light in weight and easily handled, even by a novice. It is a valuable accessory.

The Apparatus employed with the Lear Radio Compass occupies only a small space and is light in weight.

What Our Readers Are Building

Here we show the various types of aircraft, built and under construction, that are being produced by our readers. We solicit photographs of your job with a short description attached so that your fellow constructors can see what you are building.

RECENTLY, we received a letter from our old friend Stanley Rowan, the world renowned bedroom airplane builder, whom many of our readers will remember. It seems good to know that he is still as enthusiastic as ever and is still flying the Heath Parasol that he built in Chicago. His address is now RD-1, Box 49, Evans City, Pa.

His little ship, which has seen about 70 hours' service, has never laid down on the job yet and has had no forced landings. He swears by the Heath B4 engine with which it is powered and it grinds him mightily to hear the palookas make wise-cracks at his expense. The proverbial 99.44 percent. of the critics, according to Stan, have never flown with one and therefore are talking away out of turn.

He says that she slides through the atmosphere at a top speed of 85 m.p.h. with a cruising speed of 66 m.p.h. And when she lands she rolls a few feet, starting in at about 30 m.p.h. The rate of climb is 600 feet per minute.

Stanley says that, theoretically, this ship should have a ceiling of 20,000 feet, but he has only reached 10,000 feet so far. One day he was still climbing well at 10,000 feet, but unfortunately the whistle blew and Stan had to come down and go to work.

R. L. Park, St. Paul, Minn., sends us a picture of three lightplanes lined up on the field near St. Paul. This group includes two Pietenpols and a Hallman, all of which are powered with Ford Model A engines. He also tells of a modified Hallman now under construction that will be powered by a converted Ford engine. This ship is being built by Bob Sylvester and Gordon Kindlien at 1114 White Bear Ave., St. Paul, Minn.

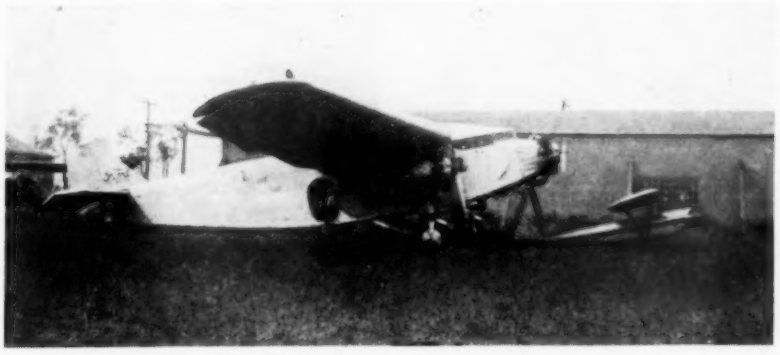
And here is the "Sky Baby," designed and built by Sterling Barnes, Box 113, Escalon, Calif. He was assisted in this pastime by Edward Gomes who helped to saw the boards, dope the fabric and all the rest of it. Sterling had the welding done at a shop, thus avoiding the worst part of the job.

And Mr. Barnes is philosophical in addition to his other excellent qualifications. He states, "As an experienced dream-ship designer of the 2 a.m. variety, I can testify that what looks like hot stuff in the wee sma' hours often turns out to be a total washout in the cold gray dawn of the morning after."

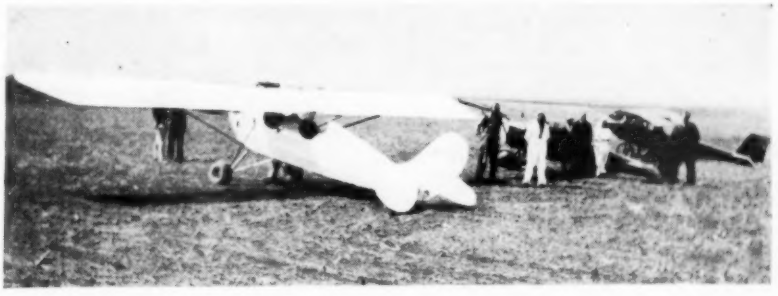
It is powered with a Salmson AD9 engine, developing 40 h.p. at 3,000 r.p.m., and with this engine and a specially designed propeller, the Sky Baby puts up a surprising performance, particularly in takeoff and climb. Test pilots have care-

(*Concluded on page* 333)

Three Fine Examples of Our Readers' Work



Is the horrid old trimotor chasing Stan Rowan's little parasol or is this a parade? Anny-whoo, this little ship has shown a reliability second to no plane, no matter how large, and Stan Rowan should be given a great big hand for this job.



Here's a lineup of Ford powered ships that some of our engineers should look over, particularly Mr. William Stout who seems to have missed a lot of fun in this life. This group consists of two Pietenpols and a Hallman, located at St. Paul, Minn.

Here's the hot looking "Sky-Baby" built by Sterling Barnes and powered with a Salmon AD9 radial engine. This ship was designed, a la Dreamship by Mr. Barnes who certainly puts up a nice looking job both in design and construction.

XUM

A Few Gas-Powered Models

by ARTHUR JACKSON

We will be very glad to receive contributions to this department, describing your gas-powered model. We have a few more photos on hand, but they will be exhausted in the next issue if you fellows don't hurry up and kick in with your job.

A FRIEND of ours, P. J. Sweeney, 4508 Broadway, Chicago, Ill., dropped in our office the other day and gave us the dope on his latest gasoline propelled model. This model was built for competition in the St. Louis Meet, but owing to an unfortunate accident taking place just before the events were called, it was not entered.

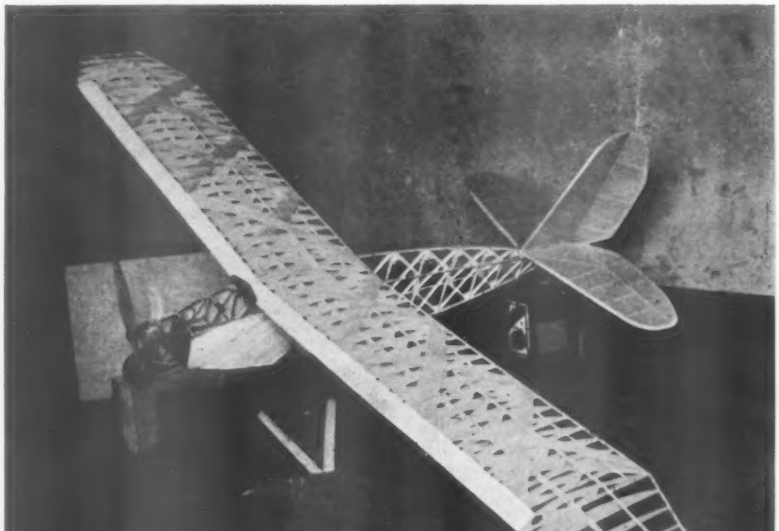
The Sweeney model has a span of 8'-0" and a 17-inch chord. The fuselage is constructed with ¼-inch spruce longerons. The spars and leading edge of the wing are spruce to which are fitted balsa ribs. Both the fuselage and the wings are of tissue with four coats of dope.

One of the most interesting features is the inverted 1/5 horsepower engine carried by a monel metal mounting. All of the powerplant equipment is also mounted with the engine so that a single and independent unit is had. It has a top speed of 14 m.p.h. and a landing speed of 8 m.p.h.

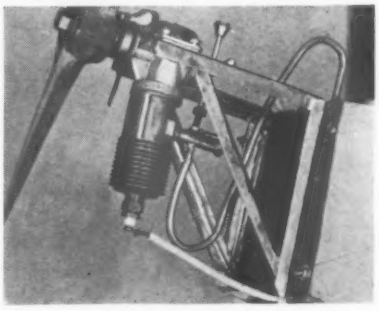
Mr. Sweeney, who is a World War veteran, is very desirous of boosting the gasoline model field and proposes that a national association of men and boys interested in gas models be formed. He gets a lot of kick out of gas models and wishes to hook up with other enthusiasts in this great sport. If interested, write to him for a membership, enclosing a stamped addressed envelope for reply. He will act as temporary president and chairman of the board until a permanent organization can be effected.

Another very interesting gas-powered model is that built by Will Walling, Jr., 165 So. Vateriah Ave., West Los Angeles, Calif. As will be seen from the accompanying photo, this is a beautifully constructed job of the parasol monoplane type.

The Walling model has a wing span of 5'-6" and weighs three pounds, five ounces. The Brown Junior engine, mounted inverted, turns a 14 inch propeller at 3,700 revolutions per minute which gives the model a top speed of approximately 35 miles per hour. The wing section is the very stable N.A.C.A. M-6 section which undoubtedly accounts, at least partly, for the excellent stability shown in flight.



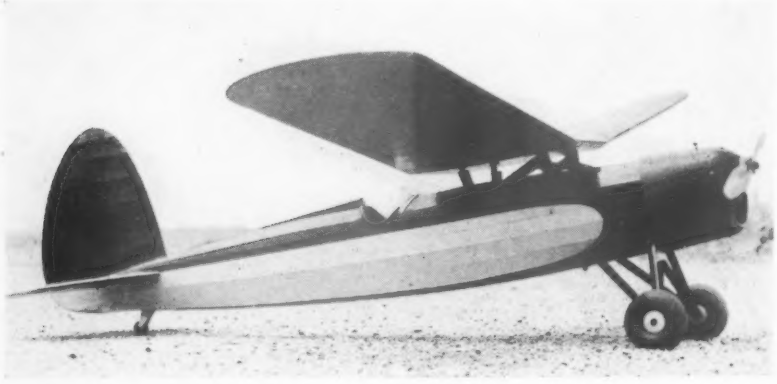
This is the uncovered framework of P. J. Sweeney's gas-powered job. Note the careful rib and wing construction.



This is the inverted engine mounting on Mr. Sweeney's model. The front section is removable.

On the first test hop, this model flew eight minutes, thirty seconds on two eye-droppers of fuel. This flight was proportioned so that the engine ran for one minute, 30 seconds, while the remaining six minutes, thirty seconds was gliding time. It traveled two miles outside the Metropolitan Airport, San Fernando, Calif., where the trials were made.

To date, the model has made ten excellent flights. The builder calls our attention to the tab on the rudder which can be adjusted for neutralizing the propeller torque. We trust that Mr. Walling will favor us with further information from time to time on his experience.



This is the fine gas-powered model constructed by Will Walling, Jr. It has a top speed of 35 m. p. h. and shows great stability in flight.

And now, we will investigate the fine little gas powered model built by W. Davis, 3008 East 31st St., Kansas City, Mo. This ship is also equipped with the Brown Junior engine and weighs four pounds, 12 ounces. The wing has a span of six feet.

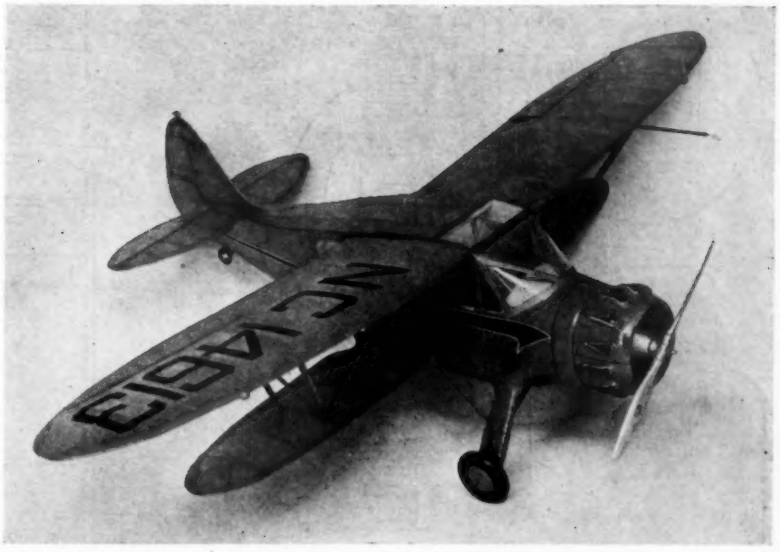
The Davis model has an unofficial record of 20 minutes in which time it flew approximately seven miles, consuming 0.75 ounce of gasoline. This works out at a speed of 21 miles per hour, but Mr. Davis does not say how much of this flight was under power and which part was glide.

Building a Waco Cabin Model

by

PAUL W. LINDBERG

Model designer and model editor of
POPULAR AVIATION



The completed model of the Waco cabin plane is true to life and, being a biplane, is an excellent flyer. It will be well worth your while to build this attractive model.

THE model builders consider this Waco model very popular. This model is of the latest design. It is equipped with shock absorbing landing gear, movable controls which carry aluminum hinges and other interesting features. Unusually stable and excellent flights are obtainable with this model.

COLOR SCHEME

Entire model; red
All details; black and white

CONSTRUCTION OF FUSELAGE

First, place waxed paper on top of plan to prevent parts from sticking to it. The fuselage sides are built from $\frac{1}{16}$-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips wherever needed. When the two sides are completed, the crossmembers are cemented into their proper locations. Check carefully front to rear for alignment.

Cut the formers from $\frac{1}{32}$-inch sheet balsa and cement in their respective positions as shown on the plan. Two $\frac{1}{16}$ square stringers are run along either side of fuselage and two along top and bottom. Their positions are shown on plan.

Stiff paper is required between the $\frac{1}{8}$-inch thick balsa nose plate and formers 1, 3 and 4. Note: curve of stiff paper on sides of fuselage. See plan.

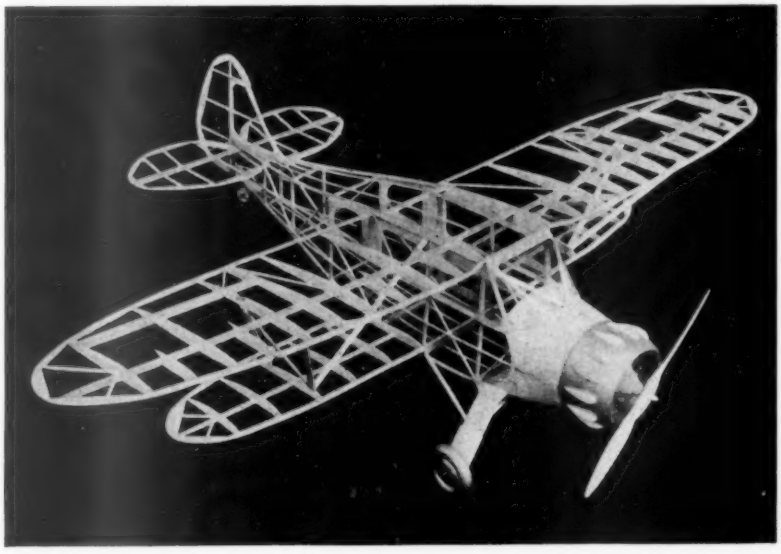
The windshield framework is made of one piece of stiff paper. Stiff paper is also used on sides for window frames. See photo of framework.

CONSTRUCTION OF MOTOR

To form cylinders, wind heavy thread around balsa blocks which have been cut and sanded to shape. The crankcase is made from three separate pieces. Rocker-arm, housings and pushrods are also made of balsa. Details of these parts are clearly shown on plan.

CONSTRUCTION OF WINGS

Cut all ribs from $\frac{1}{16}$-inch balsa. Pin the spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from $\frac{1}{16}$-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.



The uncovered framework of the Waco cabin plane, described in the accompanying article.

CONSTRUCTION OF ELEVATOR AND RUDDER

These are built from $\frac{1}{16}$-inch square and flat balsa, and are constructed on the plan. Their construction is very simple; therefore, no difficulty should be encountered here.

CONSTRUCTION OF LANDING GEAR

Landing-gear struts are made from solid balsa. Their construction is shown on plan. Reinforce all parts with piano wire, as shown. The landing gear can be built with or without the shock absorber. We recommend the shock absorber, because it helps prevent damage to undercarriage when landing.

COVERING THE MODEL

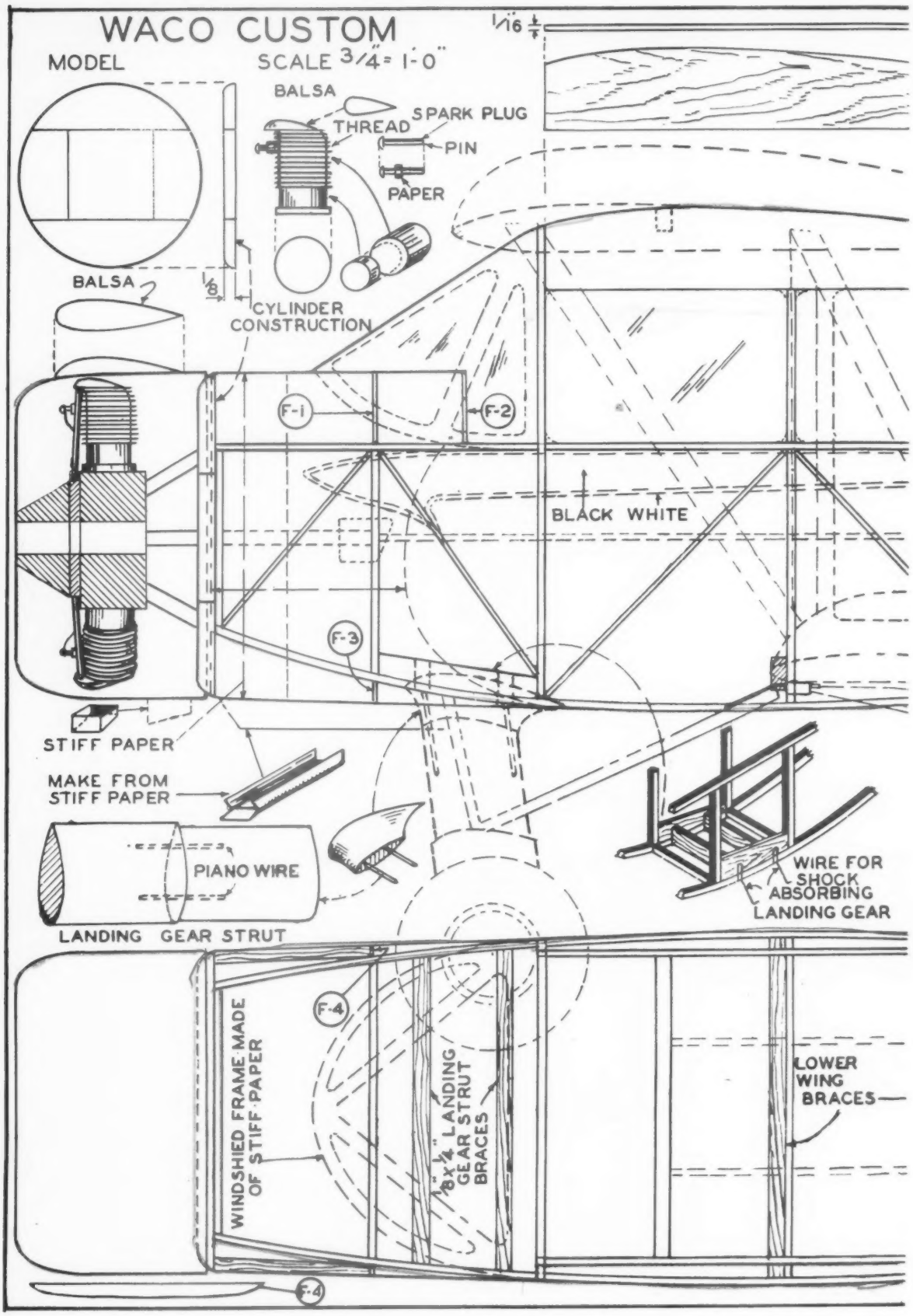
Apply tissue to the various framework members, using a light grade of model airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such to flat surface to keep from warping.

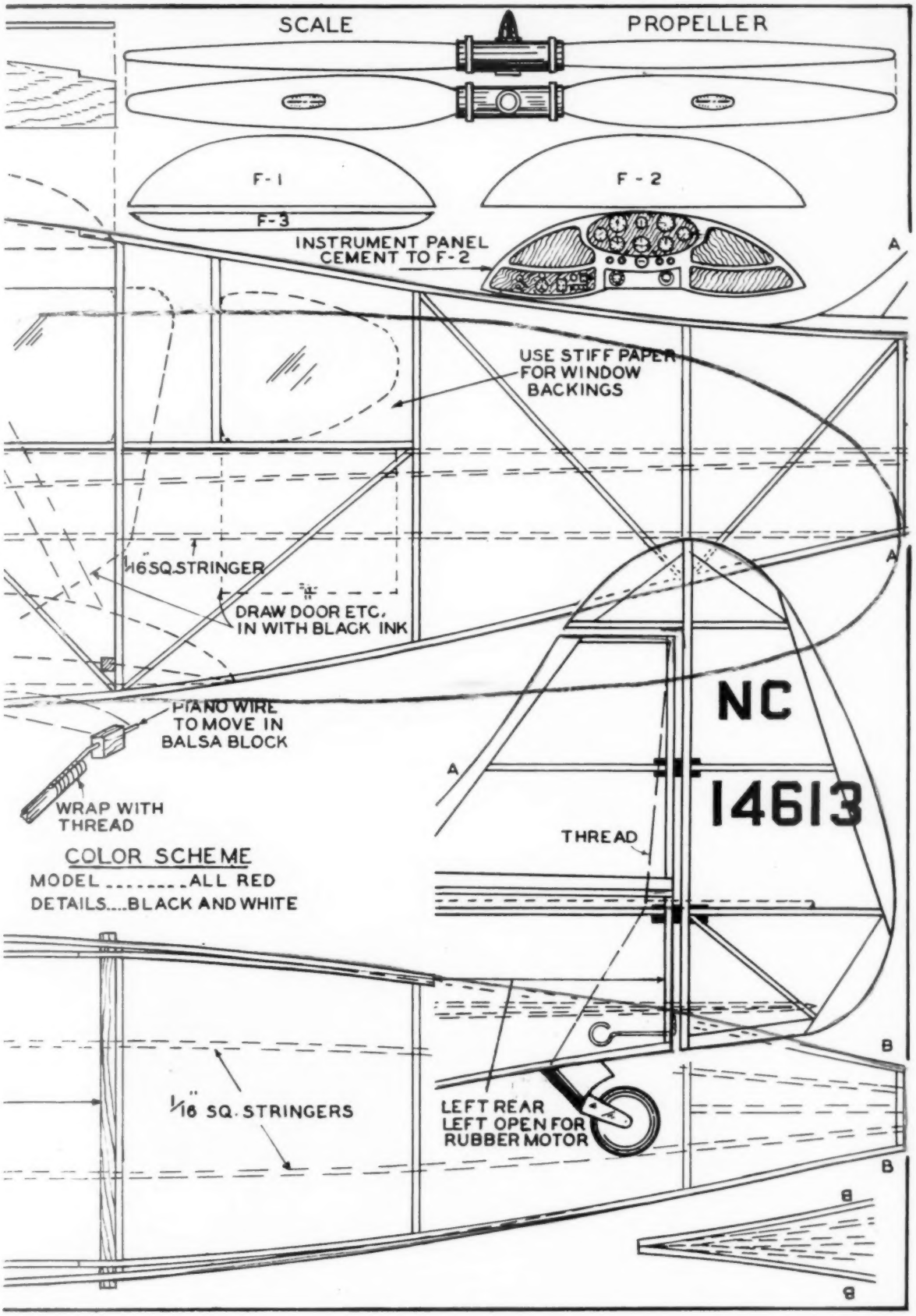
ASSEMBLY

After the various parts have been covered, the lower wing panels can be cemented into position. The lower wing

(Concluded on page 316)

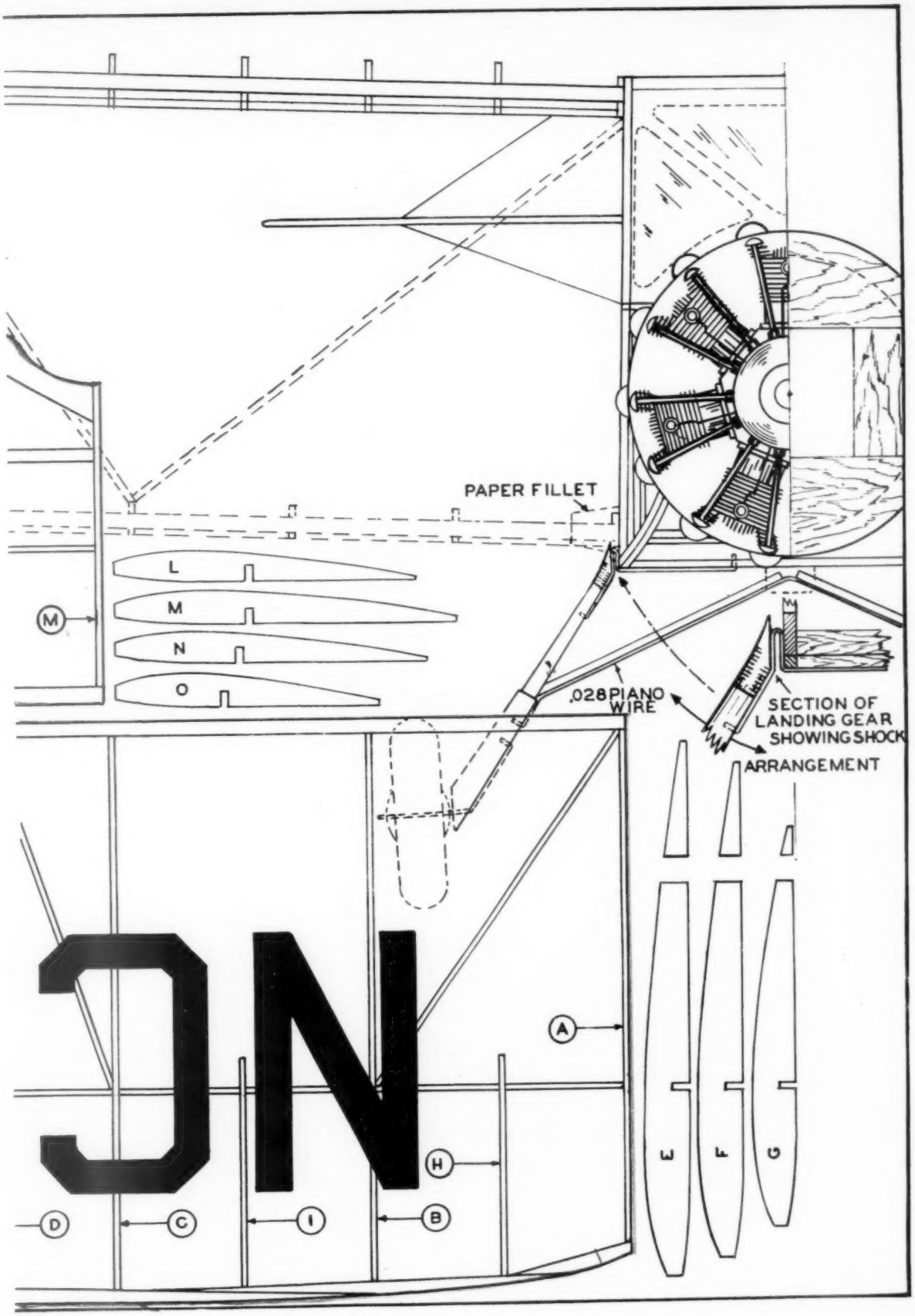
XUM


WACO CUSTOM
MODEL
SCALE 3/4 = 1-0"
1/16 +
BALSA
SPARK PLUG
THREAD
PIN
PAPER
BALSA
1/8
CYLINDER CONSTRUCTION
F-1
F-2
F-3
F-4
BLACK WHITE
STIFF PAPER
MAKE FROM STIFF PAPER
PIANO WIRE
LANDING GEAR STRUT
WIRE FOR SHOCK ABSORBING LANDING GEAR
WINDSHIED FRAME MADE OF STIFF PAPER
1/8 x 1/4" LANDING GEAR STRUT BRACES
LOWER WING BRACES


SCALE
PROPELLER
F-1
F-2
F-3
INSTRUMENT PANEL CEMENT TO F-2
A
USE STIFF PAPER FOR WINDOW BACKINGS
1/16 SQ. STRINGER
DRAW DOOR ETC. IN WITH BLACK INK
A
PIANO WIRE TO MOVE IN BALSA BLOCK
NC
14613
A
WRAP WITH THREAD
THREAD
COLOR SCHEME
MODEL ..... ALL RED
DETAILS.... BLACK AND WHITE
B
1/16 SQ. STRINGERS
LEFT REAR LEFT OPEN FOR RUBBER MOTOR
B
B
B

A
B
C
D
H
I
J
K
O
N
M
M
M
SHOWING INSTALLATION OF
ALUMINUM HINGE
SLIT BALSA WITH
RAZOR
P
G
K
F
J
E

14613


PAPER FILLET
L
M
N
O
M
.028 PIANO WIRE
SECTION OF LANDING GEAR SHOWING SHOCK ARRANGEMENT
A
H
D
C
I
B
E
F
G

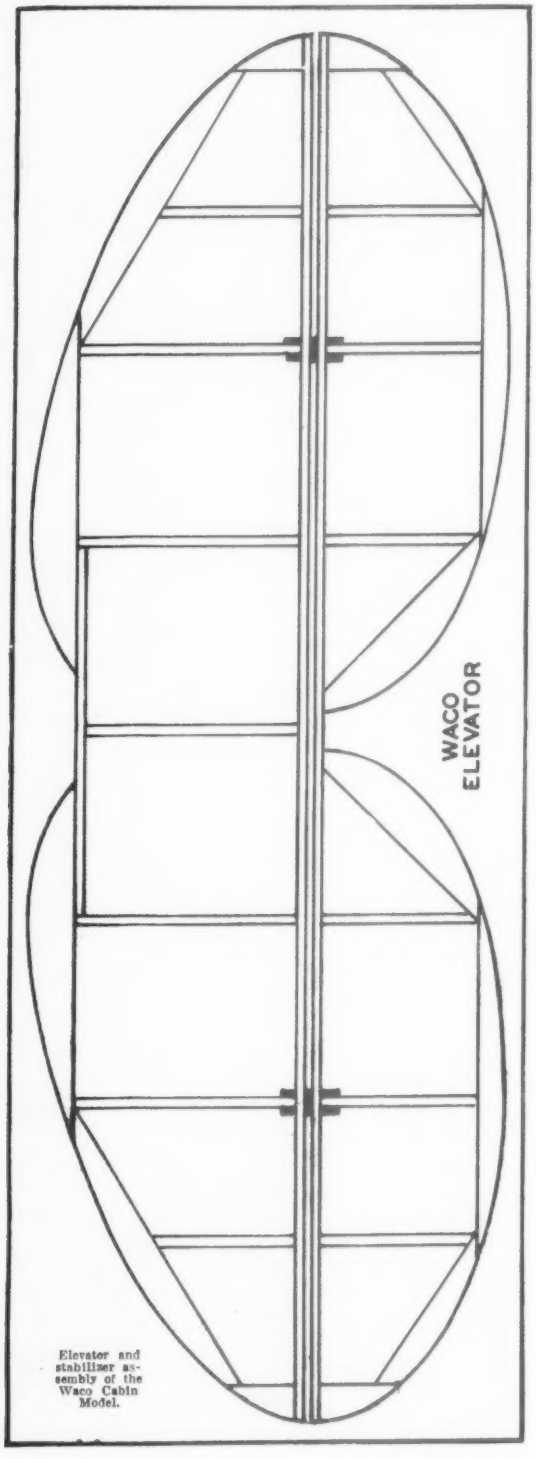
Building the Waco Scale Model

(Continued from page 311)

panels carry pins at the roots, and these pins are inserted into balsa wing beam supports which pass through bottom of fuselage.

Now, cement top wings and outer struts into position. Elevator and rudder can be cemented to rear of fuselage.

The streamline fairings on cowl are formed from balsa. The carburetor air intake is made of stiff paper and cemented to cowl. See plan. All other details shown on plan can be applied. Use thread to brace elevator and rudder.



Elevator and stabilizer assembly of the Waco Cabin Model.

TESTING AND FLYING

Two types of propellers are used on this model. One is made of fiber which has a much wider blade. This type of blade causes the motor to turn at less r.p.m. and greater flights result. By twisting the blades, the pitch can easily be adjusted. The balsa scale propeller is used for exhibition purposes only. Six strands of ⅛" flat rubber are sufficient to fly the model.

With the rubber motor and flying propeller in place, gently launch your model over tall grass. By this method, you can see if your model is properly balanced. If model glides a short distance, and nose rises abruptly, it will be necessary to add weight to bottom of nose block. If model dives, add weight to tail. After the model is balanced to glide at an even angle, you are ready to test your model under power.

In making the test flight, the principal thing to avoid is damage to your model. Gliding and flying it over tall weeds is the safest, because the weeds or tall grass break the fall gently in case that the model should stall or dive.

A few trial flights will acquaint you with the ship, and all other adjustments can be made through the adjustable control surfaces.

So far as possible, see that both blades of the propeller make the same angle with the shaft center to avoid vibration.

END.

Movie Actor Builds Gas Models

Reginald Denny and his model.

REGINALD DENNY, the well known movie actor, has gone in for building gas-powered models in a big way. But Mr. Denny is not doing this altogether as a pastime for he believes that his models can be employed in filming dramatic air movies with collisions in mid-air and all the rest of it.

Model Flying Popular in Europe

OVER in Europe where they still build models with spruce and white-pine structures, many unusual types of models have been built to meet these conditions. As the photo shows below, they still stick to the birdlike albatross idea with the upturned wing-tips, "W" dihedral.

Here we have Fritz or Louis, chasing his ten pound (estimate) albatross model.

WHAT THE IDEAL NAME MEANS TO MODEL BUILDERS

FAMOUS SUPER-DETAIL MODEL SHIPS!

Build the NEW Super-Detail Model Italian Liner, REX

29"—scale 1/32" to the foot. Patented Hull Design Shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways; 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler, sandpaper, etc. **postpaid** **$6.00**

REX PLAN

Full size plan—scale 1/32"—sheet 34" x 44"—full instructions—7 photos—25 detail views. Everything included complete, **only 25c postpaid.** Regular value $1.00.

NORMANDIE

The newest, fastest ship afloat. Beautiful new French liner.

Scale 32½" model 1/32" to the foot. New, patented hull design.

Here is a dream of a boat model that you will want to build. Normandie has a shaped hull and over 100 metal fittings—over 1000 portholes—60 metal davits—30 life boats—16 winches—24 cast metal stairways. Comes complete with all the beautiful, original high luster colors, cement, full size plan, turned wood parts, printed wood—printed fiber patterns, and everything complete that is necessary to build this model.
Postpaid **$7.00**

NORMANDIE PLAN

Full size plan—scale 1/32"—sheet 34" x 44"—full instruction—7 photos—25 detail views. Everything included complete, **only 25c postpaid.** Regular value $1.

NEW IDEAL TRU-CUT NIFE

The IDEAL knife for building models—Tru-Cut Nife. Send for this new, keen, patented, razor-edged knife. Securely fastened to a long holder it can follow intricate curves; cuts balsa like butter! Excellent for every cutting purpose. **15c postpaid. Extra blades 3 for 10c.**

DEALERS. Write for attractive advertising proposition with your name imprinted on tru-cut nife without extra cost.

For over 25 years, almost since the beginning of the aeroplane industry, IDEAL has been building the finest model planes.

We have learned a lot in this quarter of a century. And all of this experience goes into the building of the present accurate guaranteed super-detail model planes and boats.

That is why, when you deal with IDEAL, you are doing business with a company whose word you can depend on, whose kits are the finest that money can buy, and whose reliability is accepted by model builders throughout the world.

Be sure you specify IDEAL. This name is your guarantee of the finest construction, the most reliable and accurate craftsmanship. It is your assurance of perfection, of the highest standard of quality, and of square dealing throughout.

Come to Ideal for a Square Deal

Send 5c for Illustrated Catalog

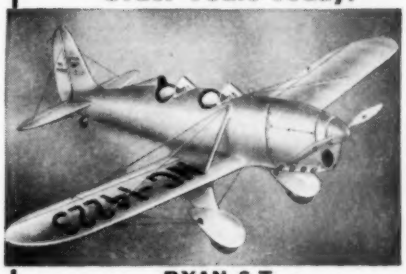
•

Contains Complete and Interesting Information

Now is the time to get acquainted with the many new features—the real value that is built into IDEAL kits. Send 5c TODAY for the colored illustrated catalogue that shows the latest model planes and boats. It also contains valuable information on how you can make real money by building and selling these famous models.

DEALERS: You can make more money with IDEAL products. Write for details of many model airplanes and ship models.

These are the Super-Detail Planes Order Yours Today!



RYAN S T

Wingspan 22½", length 16½", weight 2½ oz., scale ¾". New fast Ryan has dual control system which operates in either cockpit; adjustable wing flaps; plans for making an actual working engine—4 cylinders with movable pistons, carburetor and spark plugs.
Complete kit **$1.50**

BOEING P-26A

Wingspan 21¼", length 18", weight 2½ oz. Exact ¾" scale. This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included. Kit complete, postpaid **$1.75**

CURTISS GOSHAWK

Wingspan 23⅜", length 16¾", weight 3⅜ oz., exact ¾" scale. Coated with new IDEAL high lustre finish, with silver, yellow, red and black coloring. Kit complete, postpaid **$2.00**

STINSON RELIANT

Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Adjustable speed arresters built into the wings, movable cabin doors, complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black. Kit complete, postpaid **$2.50**

MARTIN BOMBER

Wingspan 35", length 22½", weight 4⅝ oz. Exact scale. Retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition with removable motor sticks for flying; rudder and elevator balanced surfaces; new type freese ailerons. Kit complete, postpaid **$3.50**

IDEAL AEROPLANE & SUPPLY CO., INC.

22-26 West 19th Street, New York, N. Y.

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Canadian Model Aircraft, 2039 St. Antoine Street, Montreal.

See your local dealer or send the coupon

IDEAL AEROPLANE & SUPPLY CO., INC.
22-26 W. 19th St., New York City

Please send the items I have checked. I am enclosing

$..... **(West of Denver 25c extra. All planes postpaid.) Canadian Prices 40% higher to cover duty.**

Martin Bomber ☐ $3.50 **Curtiss Goshawk ☐ $2.00**
Boeing P-26A ☐ $1.75 **Ryan ST ☐ $1.50**
Rex ☐ $6.00 **Normandie ☐ $7.00**
Stinson Reliant Airliner ☐ $2.50
Folder with information about ☐
Tru Cut Nife ☐ 15c

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Get full details on this thrilling sport; facts for fans, builders and drivers; track sizes and regulations; car specifications, pictures and working drawings. This book also shows and tells all about Indianapolis cars, Miller-Fords and world's fastest car. Brand New AUTOMOBILE RACING, *Fourth Edition*, $1 postpaid, $1.12 C. O. D.; three cents tax if you live in Ohio.

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Aviation Books

COOL weather is now with us and with it comes an ambition to study and read up on our favorite subjects. What is more interesting to an aviation fan than a good library of well selected books on aviation?

POPULAR AVIATION has for sale, aviation books of all sorts and for all classes of readers.

POPULAR AVIATION

608 S. Dearborn St., Chicago, Ill.

Marriott

(Continued from page 290)

flight, vis., sustaining power, propelling power, guiding power." Today the United Air Lines traffic office is not more than 50 yards from the site of that same Mechanics Pavilion.

Fire, nemesis of San Francisco's treasures, claimed the Avitor. But Marriott had already made plans for a large passenger carrying Avitor to be "150 feet long with a carrying power of 2500 pounds." Specifications for building it were accepted, the amount of the bid being "$3000 in coin, with an additional $175 for propeller, rudder and incidental expenses." Within a few days 225 shares of stock were sold in the company, amounting to a total of $5,615.

By 1881, Marriott had a new design which included no gas bag to offset the plane's dead weight. He believed that the steam-power of a good-sized engine would lift and sustain his ship if he made the engine light enough. When he sent in his application for a patent in 1881 on this idea, the U. S. Patent Office declared that such a thing was impossible.

Marriott died 3 years later. His son was more interested in carrying on the lucrative San Francisco News Letter than in his father's "steam Avitor," so the practical application of steam power to heavier-than-air craft was left for the Besler Brothers to accomplish in 1933.

The family made an effort to assert Marriott's claim to priority when the Wright brothers were first acclaimed, but to no avail.

Marriott's successful Avitor and his years of experimentation in aeronautics surely entitle him to a place in the history of aviation's development, from which he has been, so far, omitted.

END.

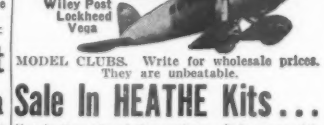
A Personal Message to Model Builders...

The HEATHE Platform Has Always Been

1. That we devote our resources and energies to satisfy our customers.
2. That we will endeavor to give our customers the highest quality, lowest prices, and fastest service of any model airplane company.
3. We will at all times be a sincere friend and adviser to all model airplane builders.
4. That our engineers shall keep the model builder fully informed on the latest inventions in airplanes, the latest accessories, and endeavor to manufacture the kits and supplies that our friends desire.

For many years the HEATHE MODEL AIRPLANE CO. has upheld the above principles as its policy. We have spent great sums in advertising, investigation, and experimentation by our staff and our engineers to protect our customers and friends and give them the best and latest merchandise at lowest prices.

FREE . . .
100 1/16 sq. x 18" Balsa strips and 6 1/16 x 2 x 18 Balsa sheets FREE with $1.00 order. Value 20c. Free with $2.00 order—250 ft. finest fresh ⅛ flat para rubber, 60c value.



MODEL CLUBS. Write for wholesale prices. They are unbeatable.

If 36" lengths are desired, just double 18" price and add 10c extra postage to order.

18" BALSA STRIPS

1/32x1/16	50 for .05
1/16x1/16	50 for .05
1/16x1/8	26 for .05
1/16x3/16	20 for .05
1/16x1/4	17 for .05
3/32x3/32	21 for .05
1/8 x1/8	20 for .05
1/8 x3/16	14 for .05
1/8 x3/8	8 for .05
1/8 x1/4	10 for .05
3/16x3/16	10 for .05
3/16x1/4	8 for .05
3/16x3/8	6 for .05
1/4 x1/4	8 for .05
1/4 x3/8	5 for .05
1/4x1/2	4 for .05
3/8 x3/8	3 for .05
1/2 x1/2	3 for .05
1/2 x1	1 for .05

18" SHEET BALSA

1/64x2	4 for .10
1/32x2	7 for .10
1/16x2	7 for .10
3/32x2	5 for .10
1/8 x2	4 for .10
3/16x2	3 for .10
1/4 x2	3 for .12
1/2 x2	2 for .15

(For 3"x18" double 2" width cost.)

18" BALSA PLANKS

1" x1"	1 for .07
1" x1½"	1 for .09
1" x2"	1 for .10
1" x3"	1 for .15
1" x6"	1 for .25
1½"x1½"	1 for .15
2" x2"	1 for .20
2" x3"	1 for .25
2" x4"	1 for .35
2" x6"	1 for .45
4" x6"	1 for .75

BALSA PROPELLER BLOCKS

⅝x ½x 5	9 for .05
½x ¾x 5	7 for .05
½x ¾x 6	7 for .05
⅝x1 x 7	3 for .05
¾x1 x 8	2 for .05
⅞x1 x 9	2 for .06
¾x1¼x10	1 for .04
¾x1¼x12	1 for .05
1 x1½x12	1 for .07
1 x1½x15	1 for .08

RUBBER

1/32 sq.	30 ft. for .05
.045 sq.	20 ft. for .05
3/32 flat	20 ft. for .05
1/8 flat	12 ft. for .05
3/16 flat	12 ft. for .05

Nose Plugs 10c Dozen

COLORLESS CEMENT

1 oz.	.05
2 oz.	.08
4 oz.	.15
1 pt.	.50
1 qt.	.90

CLEAR DOPE OR BANANA OIL

1 oz.	.05
2 oz.	.07
4 oz.	.09
1 pt.	.45
1 qt.	.85

Thinner same price as clear dope

COLORED DOPE

White, yellow orange, blue, red, green, olive drab, black, silver gold.

1 oz.	.08
2 oz.	.10
4 oz.	.19
1 pt.	.65
1 qt.	1.10

CELLULOID WHEELS

¾"	dia. ....pr. .05
1"	dia. ....pr. .0
1⅜"	dia. ....pr. .10
1⅞"	dia. ....pr. .16

¾" Finished Balsa Wheel Pants

Wheel Pants shaped ready for sanding for

	Per Pr.
½"	wheels.... .05
⅝"	wheels.... .07
1"	wheels.... .10
1⅜"	wheels.... .12
1⅞"	wheels.... .15

Turned Hard Wood Wheels

	Per Pr.
½"	diam..... .02
⅝"	diam..... .03
¾"	diam..... .03
1"	diam..... .05
1⅜"	diam..... .07
1⅝"	diam..... .10
2⅛"	diam..... .10

Turned Balsa Wheels

Light and Strong. Bushings with every pair.

	Per Pr.
¼"	diam..... .03
⅜"	diam..... .04
1"	diam..... .05
1⅜"	diam..... .07
1¾"	diam..... .12
3"	diam..... .20

MODEL PINS

Package of 100.	.05

Special Balsa Blocks for Cowlings, Nose Piece, etc.

2"x2"x2"	1 for .07
1"x3"x3"	1 for .04
1"x3"x6"	1 for .06
1"x2"x3"	1 for .05
1"x2"x6"	1 for .05

DUMMY RADIAL ENGINES

Celluloid, 9 Cylinders.

1½"	diam..... .18
2"	diam..... .23
3"	diam..... .34

BAMBOO

1/16 sq. x 14	35 for .05
1/16 x 1/4 x 11	1 for .01
1/16 x 1/4 x 11	1 doz. for .07

SHEET CELLULOID (Transparent)

4"x6"	.07
6"x8"	.07

JAPANESE TISSUE

White, per doz. .18
Colored, asst., per doz., all colors .20

SILVER TISSUE

20"x24".....each .05

SUPER-FINE TISCUE

White Only
Sheet, 5c; dozen, 50c

WOOD VENEER PAPER

15x20	Sheet .10
20x30	Sheet .15

ALUMINUM TUBING

	Per Ft.
1/16 O.D.	.09
3/32 O.D.	.07
1/8 O.D.	.07
5/16 O.D.	.10
1/4 O.D.	.10

SHEET ALUMINUM

	Per Sq. Ft.
.002 thick	.08
.005 thick	.10
.010 thick	.17

THRUST BEARINGS

Small or large, 2c each, or 15c per doz.

ALUMINUM LEAF

(.0003 of an inch in thickness, 2½ wide) 5 feet for..... .05

WASHERS

(⅛ or ¼ dia.)	
1 doz.	.01
1 gross	.10

WIRE
Straight Lengths

Nos. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, or 16.
6 ft. for..... .03

BUSHINGS

Useful for wheels, propeller bushings, movable controls, exhaust pipes, etc.

	Per Doz.
1/16 diam.	.05
3/32 diam.	.10

SANDPAPER

5 large sheets.. .05

DOWELS

	Per Doz.
1/16" diam. x 12"	.06
1/8" diam. x 18"	.05
3/16" diam. x 18"	.05
1/4" diam. x 18"	.05

6 for
4 for
3 for

REED

1/32 or 1/16	6 ft. for .02
3/32 or 1/8	5 ft. for .02

INSIGNIA SHEET

12 pr. and rudder and tail markings with gummed back. Each ..... .05

15" FLYING SCALE MODEL PLANS

Curtiss Robin, Fokker D-VII.
Each ..... .05

ENGINE AND COWL ATTACHED

1½"	dia..... .20
3"	dia..... .35

CELLULOID PANTS

½" to 1"	Pair .18
1⅛" to 1⅞"	Pair .33

MOTOR NOSE PLATES Ea.

For 1½"	motor....08
For 2"	motor. .10
For 3"	motor. .12

Accessories That Defy Competition

Be sure to include an order for accessories at these low HEATHE prices . . . each item precision made and exacting in all details.

Spun Aluminum COWLS

Dia.	Drag Ring	Open Face	Closed Face
1"	.15	.15	.15
1½"	.18	.18	.18
2"	.20	.20	.20
3"	.28	.28	.28

PURSUIT MACHINE GUNS

	Ea.
¾"	Pursuit Gun .05
1"	Pursuit Gun .05
1¾"	Pursuit Gun .10

SWIVEL GUNS

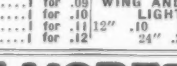
⅝"	long ..... .05
1"	long ..... .05
1⅝"	long ..... .10

BOMBS

¾" .04 1¼" .07
3" .12

GUNS WITH RING MOUNT

1" ...10 1¾"...15



READY MADE BALSA PROPELLERS

5"	1 for .05
6"	1 for .06
7"	1 for .07
8"	1 for .08
9"	1 for .09
10"	1 for .10
11"	1 for .11
12"	1 for .12

PROPELLERS

	2 blades	3 blades
1½"	.08	.10
2½"	.12	.15
3½"	.18	.20
4½"	.20	.25

WING AND TAIL LIGHTS

12" .10 15" .15
24" .20

Sale In HEATHE Kits...

Here's the sale of the century. Take your pick of the kit bargains offered in this sensational sale . . .

SEE OUR BIG PRIZE OFFER

Solid Replicas Your choice of Boeing P-12F, Texaco Sky Chief, Spad, Fokker D-VII, Lockheed Vega or S.E.5, furnished with full-size plans and separate instruction sheets and all accessories. **3 for 25c**

Every HEATHE kit contains large, simplified plans, all accessories . . . everything to complete your model.

15-inch Flyers
2 in 1 Kit, Fokker D-VII

Curtiss Robin. Astounding value! Contains complete supplies and latest new improved short cut ABC plans. Both: Fokker D-VII and Curtiss Robin. **2 FOR 59c**

HOW TO ORDER

No order under 50c. Add 15c for packing and postage to orders under $1.50. Orders over $1.50 add 10% of order. When ordering 36" lengths add extra 10c. Canada 10c extra. No C.O.D.'s.
New Big Catalog FREE with all orders or upon receipt of 5c.

HEATHE MODEL AIRPLANE CO.

438 East 98th Street :: Drawer 611 :: Brooklyn, N. Y.

Injection Type

(*Continued from page* 306)

lbs. fuel per hr. with 0.719 specific gravity fuel at 1100 r.p.m. and requires approximately 0.35 hp. to drive it at rated conditions.

"The fuel outlets are in the mounting face and the injector is mounted with nine hollow combination mounting and fuel-feed bolts. Drive is through a 3-in. Oldham coupling offset 1/16 in. to permit exchange of units without retiming. Lubrication is obtained from the engine system by a metered oil squirt through the center of the Oldham coupling.

"The oil is distributed inside the injector by the centrifugal force of the rotating parts and is returned to the engine by gravity. The injector is fitted with a spring loaded timing-pin which drops into a notch, if it is depressed when the injector is in position to start discharging to number one cylinder at full stroke.

"The strainer cap is fitted with a relief valve which regulates the pressure of the fuel supply to 3 lbs. per sq. in. A fixed element screen of 0.0025 in. free opening is fitted at one end of the injector and is retained by a snap ring. Removal of the screen is accomplished by removing the strainer cap which is held by one screw and removing the snap ring."

During the entire period of development, attention has been given to installation and timing, in order to make possible the exchange of units by unskilled mechanics, and as a result the modern injector is fool-proof, as far as manipulation in the service is concerned. However, a redesign of present radial engine rear and center sections was necessary, to accomplish this possibility.

Installing the present type of injector on a redesigned motor requires no more skill than is essential in setting the engine for a given position of the cycle and bolting on the injector. Once installed, it is difficult deliberately to cause interference with the injector operation, a decided feature of improvement over carbureter systems.

The injector design has been arranged so that a minimum of tools is required for servicing and assembling and the device is capable of 1,000 hours of operation without replacement or change in performance.

A series of discharge nozzles was developed before one type was selected as being suitable for use in fuel injection systems. Quoting again from Mr. Campbell: "With this nozzle, fuel discharges uniformly around the circumference of the seat in a flat sheaf. The heavy or penetrating part of the sheaf upon striking the baffle ring is formed into a conical sheaf and is deflected against the air current flowing to the cylinder.

"The velocity of the air is sufficient to bend immediately the sheaf around approximately 120 deg. during which time a great deal of vaporization and intimate mixing is accomplished. The

(*Concluded on page* 320)

TRY *SELLEY-TEX FLYING MODEL KITS! A NEW REVOLUTIONARY *Practical* METHOD OF SIMPLIFIED BUILDING!

GOSHAWK A POWERFULLY attractive flying scale replica of the speedy Navy fighter and accurate to the minutest detail, and what a flyer! The SELLEY-TEX moulded parts and materials as listed complete this outstanding value.

$4.00
25c postage

Simple as ABC
A—Fit together and cement the two moulded parts of the fuselage.
B—Cut away the border of excess fabric.
C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

All other SELLEY-TEX moulded parts as listed are equally easy to build.

SELLEY-TEX OFFERS 10 ADVANTAGES over all-balsa-stick Kits!
1—**MOULDED CONSTRUCTION.** First real advancement in practical building.
2—**EASIER-TO-BUILD.** The moulded parts make it simple as ABC.
3—**EXCLUSIVE FABRIC.** Specially close woven and processed by secret formula.
4—**MORE PRACTICAL.** Selley is discontinuing All Balsa Stick type entirely.
5—**MORE AUTHENTICALLY DESIGNED.** Minute details are moulded into model.
6—**MORE DURABLE.** The moulded shell is stronger and lighter.
7—**BETER FLYERS.** The moulded fuselage eliminates weight behind center of gravity.
8—**POSITIVE MEANS OF BALANCING.** Simple ring device correctly balances plane.
9—**FINISHED ADJUSTABLE PITCH ALUMINUM PROPELLER.** Maximum of thrust and minimum of rubber.
10—**FULL MONEY BACK GUARANTEE.**

BIG VALUE!

Selley-Tex Moulded Parts for Goshawk
All SELLEY-TEX moulded parts are beautifully finished.
1--Right fuselage shell
2--Left fuselage shell
3--Belly tank
4--Drag ring
5--Balancing ring
6--Motor
7--Bomb shells
8--Head rest
9--Pants shells, R & L
10--Bulkhead
11--Pants fairing
12--Tail wheel fairing

Each of the SELLEY-TEX Construction Sets contain the necessary individually designed moulded scale parts similar to those shown above.

LISTED PARTS AND ACCESSORIES
Every model is packed in a beautiful, sturdy box with finished scale flying, adjustable pitch metal prop, finished propeller shaft and rear hook, scaled wheels, with brass bushings, ribs printed out accurately on white sheet balsa, many special turned wood parts, finest grade of balsa wood, sticks, tail wheel and fork fittings, control horns and wire, pure para rubber, special bamboo paper, authentic markings, colored inginia, best quality cement, colored dopes, full-size easy-to-understand plan, complete with all picture details. All the tools necessary to build model:
CLAMPS—RAZOR BLADE, BRUSH, SANDPAPER
ALL 24-INCH WING SPAN

FREE! Write for our beautiful, two-colored broadside illustrating in detail the new line of incomparable SELLEY-TEX Construction sets. Send 3c stamp for postage.

See your local dealer or mail this coupon today
Please send me the SELLEY-TEX model kits I have checked. I am enclosing $.....
(Each plane 25c postage. West of Denver 35c postage.)

NEW RYAN SPORT	3.00 ☐	FAIRCHILD	3.00 ☐
WACO C CABIN	3.50 ☐	BOEING FE84	3.50 ☐
WACO D MILITARY	4.00 ☐	GOSHAWK	4.00 ☐

Name .....
Address .....

DEALERS! Cash in on the growing demand! Write for discounts, propaganda, etc.

BUY the FINEST QUALITY PARTS and SUPPLIES

PROPELLERS

Hawk Type 2-bladed		Hawk Type 3-bladed		DIE CAST 2-bladed		DIE CAST 3-bladed		Standard 2-bladed		Standard 3-bladed	
3½"	25c	4"	35c	1½"	8c	1½"	10c	1½"	10c		
4"	30c	4½"	45c	2"	10c	2½"	15c	2½"	15c		
4½"	35c	5"	50c	3½"	15c	4"	25c	4"	25c		
5"	35c	5½"	50c	4"	20c	4½"	35c	4½"	35c		
5½"	40c	6½"	70c	4½"	25c	5"	45c	5"	45c		
6½"	40c	7"	80c	5"	30c	6"	60c	6"	60c		
7"	55c	8"	80c	5½"	35c	7"	70c	7"	70c		
8"	65c	9"	$1.00	6"	40c	8"	80c	8"	80c		
9"	75c	10"	1.10	6½"	45c	9"	90c	9"	90c		
10"	85c	11"	1.25	6¾"	50c	10"	$1.00	10"	$1.00		

Props can be had up to 24 in. dia. Postage 6c each.

Aluminum Disc Rubber Tired Wheels		Aluminum Disc Rubber Tired Air Wheels	
½" dia.	5c ea.	1" dia.	15c pr.
⅝" dia.	6c ea.	1¼" dia.	18c pr.
¾" dia.	7c ea.	1½" dia.	20c pr.
⅞" dia.	8c ea.	**Celluloid Balsa Wheels**	
1" dia.	9c ea.	¾" dia.	06c pr.
1¼" dia.	10c ea.	1" dia.	08c pr.
1¼" dia.	11c ea.	1⅜" dia.	10c pr.
Balloon Tire Alum. Disc Wheels		1⅝" dia.	18c pr.
1½" dia.	25c pr.	3" dia.	35c pr.
1⅝" dia.	25c pr.	**Balloon Tired Celluloid Disc Wheel**	
2" dia.	30c pr.	1½" dia.	30c pr.
Treaded Rubber Tire Aluminum Disc		1¾" dia.	33c pr.
1 3/16" dia.	30c pr.	2" dia.	35c pr.
1½" dia.	40c pr.	**AXLES Threaded and fitted with washers, bushings and nuts.**	
2" dia.	50c pr.	**Lengths**	**1/16 3/32 1/8**
2½" dia.	60c pr.	2"-5"	.06 .12 .10 .20
5⅝" dia.	$1.50 pr.	7"-8"	.09 .14 .12 .23
6½" dia.	$2.00 pr.	10-11-12"	.18 .15 .25
7" dia.	$2.50 pr.		
Axle Fork and Swivel Joint			
⅛ up to ⅝" wheel	10c		
¾ up to ⅞" wheel	15c		

WHEELS
SEND 5c FOR CATALOG

Postage 3c pair, on Rubber Tired Wheels, 4c pair

Bombs and TORPEDOES

13/16"	3c
1¼"	8c
3" Torpedo	15c

DUMMY MOTORS Something New
9 Cylinder
1" dia. 30c
1⅛" dia. 50c

Die Cast New Guns

WITH RING MOUNT
1¼" long B 25c
1⅝" long A 30c

SWIVEL TYPE GUNS C
2" Double Action.. 15c

PURSUIT TYPE GUNS D
⅝" long 04
1" long 05
1⅛" long 05

TYPE E
1¾" long 10c

TYPE F
1¼" long 10c

G DUMMY RATCHET GUN
⅞" long 5c

3c Postage

CELLULOID MOTORS Postage 3c

Separate Cylinders		Celluloid Dia. Motors		Aluminum Cowl Plates		Celluloid Motor & Cowl Combination	
5/16"	3c	1½"	25c	⅞"	8c	1½"	25c
⅜"	4c	2"	30c	1"	10c	1½"	25c
½"	5c	3"	35c	1⅛"	12c	3"	35c

Spun Aluminum COWLS

Dia.	Drag Ring	Open Face	Closed Face
1"	.15	.15	.15
1⅛"	.18	.18	.18
2"	.20	.20	.20
3"	.28	.28	.28

Postage 3c

Authentic 2¼"x4¼" Airplanes
24 ARMY .25c Set
16 NAVY .25c Set
16 WARTIME .25c Set
84 SQUAD. INSIG. .25c
Postage 3c

Dummy Turnbuckles
¼".....10c each ⅜".....10c each ½".....10c each

IMPORTANT—Minimum order, 50c. Add postage on all items but if over 15c on less than $1.50 order add only 15c. Orders over $1.50 add 10%; west of Denver 15%.

SELLEY MFG. CO., Dept. 411 1373 Gates Avenue, Brooklyn, N. Y.

New OUTBOARD Motor Sled READY

For Home Builders

Now you can easily build Mead's new, streamlined MOTOR SLED at home from drawings, parts or complete Construction Kit. Uses any OUTBOARD engine. Amazing speed. Low cost. Also: Ice-Boats, Ki-Yaks, Sailboats. Rush 10c for illustrated literature.
MEAD GLIDERS, 12 S. Market, Dept. 11-ES, Chicago

New! This Amazing Addition to Model Aviation

LILLIPUT LIGHTING KIT FOR AIRPLANE & SHIP MODELS

Note Navigation Lights

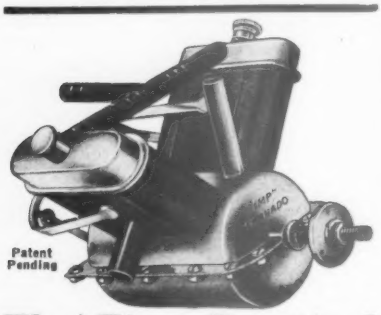
Wire up and illuminate models with real navigation lights.

Genuine Midget Electric Bulbs, only 7/32" diameter, burning on any 2 cell battery.

CONTENTS OF KIT: 3 Lilliput Pea-Lamps, 1 red, 1 green, 1 white, each with 22" specially thin flexible wire-cord; 1 miniature base connecting-plug to fit any flashlight or electric lantern or penlite; complete instructions for installation, (or all 3 lamps white if desired for cabin or landing lights). Satisfaction Guaranteed. If Local Dealer cannot yet supply we will mail you complete Kit postpaid for..... 85c

Dealers interested in carrying our line write:

HELIOS PRODUCTS CORP.
799 Broadway Dept. P11 New York, N. Y.



Patent Pending

The First Practical Low Priced Power Plant for Model Airplanes!

Put pep and go into your Models with a real power unit that will give you big plane performance. Do it with an

"IMP" TORNADO MOTOR

You can build it into the nose of any type model; the one you have now or a new one; entirely out of sight. It will swing large propellers at high speed for long flights. Easy starting, no stalling, costs hardly anything to operate. Runs on AC:CO Gas, generated in the "IMP" Generator; a new invention that will revolutionize model flying. Will also run on compressed air.

Model V-4 (shown above) four cylinder. Weight only 3½ oz. Will fly models from 4 to 8 feet. Complete with Generator, Feed Line and Safety Clip..... $7.50

Model S-2, two cylinder. Weighs 2½ oz. Flies models 3 to 6 feet. Complete with Generator, Feed Line and Safety Clip..... $5.00

(If ordered by mail, add 25c for postage)

Send for FREE Circular right now and find out about these Motors.

All Prices Reduced on the Genuine "IMP"

PAULOWNIA

(Reg. Pend.)

WOOD PROPELLERS

All prices now greatly reduced on every size and style. Send 3c for Propeller Guide showing complete range of styles and sizes.

INTERNATIONAL MODELS COMPANY
1785 Broadway, General Motors Bldg., New York

Distributed on Pacific Coast by Lawrence W. Brown Aircraft Company, Model Plane Div., Willowbrook, Calif.

Injection Type

(*Continued from page* 319)

fine mist present around the seat and baffle ring is swept towards the cylinder and disappears from sight after having moved 3 to 4 in., because of being vaporized.

"All vaporization, including that of the heavy part of the spray is practically completed by the time the charged air is 7 in. downstream from the leading edge of the nozzle. A fixed element type fuel screen with 0.001 in. free opening is fitted to the nozzle assembly. Even with this precaution against foreign material, erosion of the seat and diaphragm will occur after a few hours of operation unless these are made of selected materials. A common stainless steel, cyanided, was found to be satisfactory for the seat, while tantalum, specially heat-treated, is required for the seating diaphragm."

Observation of the performance of various nozzles indicated that the device must be dried immediately after the injection pressure surge subsides and should remain so until the beginning of the next succeeding surge. Any pocket or projection between the nozzle seat and the point at which fuel leaves the nozzle assembly will increase the time required to vaporize the fuel, lengthen the period to dry the nozzle and reduce the chances for complete vaporization in the intake pipe during the suction stroke.

The tendency for partially vaporized fuel to condense to a liquid immediately upon hitting a projection must be fully realized and provisions to reduce this to a minium are essential. With a good nozzle arranged properly in the induction system, it is possible to have the charge, during each suction stroke, completely vaporized before it enters the combustion chamber.

Perhaps the most important consideration in making a proper application of induction-system fuel injection to the Otto cycle engine is that of phasing the fuel discharge with the suction impulse. In order to determine this, it is necessary to know the instantaneous velocity during the entire suction stroke for all speeds and loads in the complete range of operation. Computed velocities were unreliable since the pressure surges in the induction system were not uniform between cycles and it was not possible to know if the pressure differences recorded were actually present or if it was due to the occurrence of a pressure surge.

Final success was attained by installing a special nozzle with provisions for use of a rotoscope, observations being made during the suction stroke. Thus, by actual vision, working of the induction system could be correlated with data on the phenomenon which caused the action.

END.

State Rules

(*Continued from page* 304)

program includes such activities as the construction, beautification and maintenance of airports, air marking, erection of hangars, shops and other buildings, lighting of airports and airways, aerial photography, extension of airlines, air education and promotion, radio facilities and upper air observation station.

In their air marking projects, they have a few thousand roadside directional markers (8"x30" boards) placed near the entrance of each airport and another similar size sign is erected one-half mile in each direction from the airport with arrows being placed at cross-roads within several miles of the fields. These distinctive markers are white with international orange letters and the posts are painted in alternate bands of these colors. Their official airway map is reputed to give more information relating to aviation than any other airway map.

Illinois, which ranks third as regards the registration of pilots and aircraft in the United States, is also another of but few states that own aircraft for its officials. The use of aircraft by states is considered by the Illinois Aeronautics Commission, of which L. P. Bonfoey is chairman, as being of increasing importance. It has been recommended that planes can be of assistance to the police, forest fire, flood and other disaster relief work, mapping, road, traffic and drainage surveys, photography for publicity and records and transportation of officials.

END.

GET MORE FOR YOUR MONEY--BUY AT IMPERIAL

Postage paid on all orders in United States for 75c or over. Under 75c, add 10c. Canada and foreign, add 15%. Free catalog. NO STAMPS. No C.O.D.'s

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1/16x1/16 ....100 for 5c
1/16x1/8 ..... 35 for 5c
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1 doz. all col., AA....19c

SILVER TISSUE
20"x24" .....each 5c

SUPER-FINE TISSUE
White Only
Sheet, 5c; dozen, 50c

BALSA WHEELS
½"... 3c ¾"... 4c
1"... 5c 1¾"... 7c
2"... 10c 3"... 17c

DOWELS
1/16x6 .....doz. 5c
⅛x18 ..... 2 for 5c

INSIGNIA SHEETS
24 insignia and stripes.5c

WASHERS
1 doz. ⅛ and ¼ 1c

PROPELLER BLOCKS
½x ¾x 6 .....6 for 5c
⅝x1 x 7 .....3 for 5c
¾x1 x 8 .....3 for 5c
¾x1¼x10 .....2 for 5c
¾x1¼x12 .....1 for 4c
1 x1½x12 .....1 for 7c
1 x1½x15 .....1 for 9c

MODEL PINS, pkg. 5c
THINNERS, 1 oz. bot. 5c
REED, 2 ft..... 1c
BUSHINGS, 1 doz.. 3c
SANDPAPER, pkg.. 5c
PROP. SHAFTS, doz. 8c
NOSE PLUGS, doz. 10c

FREE!

BIRCH WHEELS
½"....2c ¾"....3c
1"....4c 1¾"....5c
2"....10c

SHEET ALUMINUM
.005 in. thick, 6x6....5c
.010 in. thick, 6x6....6c

CLEAR DOPE
1 oz....5c ½ pt....30c

COLORED DOPE
1 oz. bot., all colors.. 5c

CLEAR CEMENT
1 oz. bot. 5c; 2 oz. bot.10c
½ pt. bot.....35c

MACHINE-CUT PROPS.
5".... 5c 6".... 6c
7".... 7c 8".... 8c
10".... 10c 12".... 12c

Dealers, Clubs, Schools: Write for Price List.

IMPERIAL MODEL AERO SUPPLY, Dept. A
416 McDonald Ave., Kensington Sta., Brooklyn, N. Y.

With every order of $1.00 or over postpaid—
2 oz. bottle CLEAR CEMENT and 100 1/16x 1/16x18 BALSA STRIPS

WIRE
2 ft...1c 25 ft...10c

BAMBOO
1/16x1/16x12 .....36 for 5c
1/16x¼x15 .....ea., 1c; doz. 10c

THRUST BEARINGS
Small, doz.....10c
Large, doz.....15c

RUBBER
1/16x1/16 ...18 ft. 5c
1/8 flat .....15 ft. 5c

WOOD VEN. PAPER
20x30 .....1 for 10c

SHEET CELLULOID
6x8.. 5c 12¼x16..20c

CELLULOID WHEELS
¾" pr. 5c 1¼" pr. 10c
1" pr. 7c 1⅞" pr. 17c
3" pr. 30c

20 IN. FLYING PLANS 10c—3 for 25c
Sparrow Hawk, Boeing Trans., 247, Spad Chass., Bright Dragon, Curtiss Swift, L. W. Wasp, Cabin Biplane, Curtiss Hawk, Boeing P-12-F, Fokker D-VII, SE5, Goshawk, Gee Bee.

"900 Foot Flights" "Fly Like Birds"

THEY WRITE

From NORTH to SOUTH from EAST to WEST EVERY BODY IS FLYING OUR

5 FOOT SCALE MODELS ACTUALLY the SIZE 1/3 of REAL PLANES!

$1 EACH PLUS 35c for PACKING, POSTAGE & INSURANCE

IF EXPRESS COLLECT SEND ONLY $1.00

Amazing is all we can say—but why not? We are receiving thousands of letters from all parts of the country praising our new Giant Models—letters that are delirious with joy speaking of the real flying achievements of these planes that are actually 1/3 the size of real passenger carrying planes. Even we are overwhelmed at the terrific response of the model builders of America—a response which has exceeded our wildest expectations—17,000 of these models have been sold and built (proof of this in our files)—representing 17,000 enthusiastic endorsers of our planes. Doesn't it thrill you? Imagine!—amazing gigantic models—each a strong outdoor flyer!—a $10.00 value for only $1.00. Everything is in the kit INCLUDING ALL LIQUIDS—nothing else to buy! There is no catch! Inspect our kits at any dealer or read for yourself what each kit contains. If you are not convinced that our kits are not the biggest values, don't order. If you already realize what bargains our kits are, send your order today and in a few days you will be the owner of a beautiful flying scale model that will make you the envy of your schoolmates and neighborhood.

5 FT. STINSON RELIANT

5 FT. HEATH PARASOL

CONTENTS: Each of these new G. H. Q. Giant 5 ft. Model Planes contains full size Plans, all ribs, formers and curved parts clearly printed on best grade Balsa. Large bottles Cement and Dope, different colors Japanese Tissue, Special Endurance Rubber, finished Ready-Cut 3" Wheels, Wire, Balsa strips cut to size, Washers and . . . Movable Controls, shock-proof Landing Gear, Scale Details, Lettering, Numbering and Insignias, Flight Log, etc.

NOTE: We have dealers in almost every city. Visit your dealer first for our kits. If you cannot locate a dealer who can supply you, order direct from us. Send money order, check, stamps, or cash. Send only one dollar if you want express delivery, charges collect. **24 HOUR SERVICE ON ALL ORDERS**

G. H. Q. KITS

FLY BETTER — COST LESS — CONTAIN MORE!

ALL HIGH QUALITY — ACCURATE for EXPERTS — EASY for BEGINNERS!

"900 FOOT FLIGHT"

Wellsville, Ohio.
May 28, 1935.

G. H. Q. Model Airplane Co.,
564 P. South Boulevard, New York, N. Y.

Dear Sir:

Enclosed please find a money order for $1.35 for which please send me your 5 ft. Monocoupe.

I have built your five foot Stinson Reliant and it turned out all right. I got flights of 900 feet from it.

I want to build this monocoupe and see what kind of flights I get from it.

Please send the Monocoupe as soon as possible, because I am anxious to get started on it.

Sincerely yours,
Robert Truax.
R. D. 1, Wellsville, Ohio.

"FLY LIKE BIRDS"

June 28th, 1935
Lemont, Illinois.

Dear Sir:

The last time I ordered a kit, I was very much pleased with it. It takes off like a real plane and lands like one. They are the most complete kits I have ever seen. Anybody who buys one of these don't have to think they are buying a cat in the bag, because they fly like birds and you don't hardly need any work to construct them.

Yours truly,
George Eliasek,
Lemont, Illinois

36" Flying Scale Models 50c plus 20c packing, postage, insurance

G. H. Q. Scale Models are the best Kits your money can buy for appearance and flights. Buy one today and you'll buy a whole fleet of them. Get acquainted with G. H. Q. Kits and no others will do.

AT YOUR DEALER OR DIRECT

And Don't Forget These Marvelous G. H. Q. Values:

24" FLYING SCALE MODELS 25c plus 10c packing, postage insurance

Each 24" G.H.Q. Kit is complete in every detail. A liberal quantity of everything. 18 models to select from at 25c each

Puss Moth
Polish Fighter
Army Falcon
Sopwith Camel
Fokker D-7
SE5
Aeromarine
Army Hawk
Monocoupe
Fairchild "22"
Aeronca
Fokker D-8
Nieuport
Douglas Mailplane
Stinson "R"
Curtiss JN4
Bellanca

24 CURTISS ROBIN, 25c

Buy these kits at your dealer—order by coupon or letter

DEALERS---IT'S SURE FIRE!!

Read this ad and judge for yourself how G. H. Q. planes are sweeping the country. They're different—there's nothing like them on the market—the biggest values—and do they fly!

17,000 5 FT. KITS ALREADY SOLD!!

Doesn't that show that G. H. Q. model airplanes have taken the public by storm? The whole country's talking about them—the smash hit for 1935!

CASH IN ON G. H. Q. KITS!!

The days of October 1st to December 31st will be red letter days for every dealer looking for new lines that will bring him increased business and greater profits. Big sales, of course, all year around too! "Ca-h in" on our national advertising campaign —one of the largest in model airplane history! This means quick sales and repeat orders. We have a complete line of kits from 10c to $1.00. Write for details and discounts today!

G. H. Q. MODEL AIRPLANE CO.

564 P. Southern Boulevard, New York, N. Y.

G.H.Q. MODEL AIRPLANE CO., 564 P. SOUTHERN BLVD., NEW YORK, N.Y.

Enclosed find $..... Please send the following kits as checked.

12" SOLID KITS
- ☐ Boeing 247D
- ☐ Ryan Racer
- ☐ G.A. Coast Guard Amphibian
- ☐ D.H. Comet
- ☐ Lockheed Orion
- ☐ Sikorsky S-41
- ☐ Douglas Airliner
- ☐ Dewoitine D-33
- ☐ U.S. Army Martin Bomber
- ☐ Monocoupe 145D

15c each Postpaid

24" FLYING KITS
- ☐ Curtiss JN4
- ☐ Bellanca
- ☐ Nieuport
- ☐ Douglas Mailplane
- ☐ Stinson "R"
- ☐ Puss Moth
- ☐ Fokker D-7
- ☐ Fokker D-8
- ☐ Polish Fighter
- ☐ Monocoupe
- ☐ Falcon
- ☐ Aeromarine
- ☐ S. E. 5
- ☐ Sopwith Camel
- ☐ Aeronca
- ☐ Fairchild
- ☐ Army Hawk
- ☐ Curtiss Robin

36" FLYING KITS
- ☐ Douglas Y-10
- ☐ Curtiss A8 Attack
- ☐ Northrop Gamma "Skychief"

5 FT. FLYING KITS
- ☐ Monocoupe
- ☐ Stinson Reliant
- ☐ Heath Parasol

SEND MONEY ORDER, CHECKS, STAMPS OR CASH. Don't Fail to Include Postage for Each Kit With Your Order. One-Day Service.

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Our Training Covers: Flight Instruction, Mechanics, Ship Maintenance, Aerodynamics, Meteorology, Avigation. Also Military and Athletics. Day or Evening. All instruction on actual planes and motors. Write or call. Rex Gilbert.

6 MONTH COURSE $49

U. S. Aviation Cadets NATIONAL HEADQUARTERS
134 5th Ave. New York City

Aero Clubs

(*Continued from page 304*)

The club membership now numbers twenty men, among which are Mr. Killian, an officer in the U. S. Naval Reserve; Mr. Cassidy, aviation engine instructor at the Rindge Technical School, Cambridge; and Mr. Hahn, formerly instructor at the Western College of Aeronautics and at present instructor in airplane rigging and maintenance at the Rindge Technical School.

* * *

AND NOW we have something really new. This is the Mountaineer Aeronautical Club of McMechen, West Virginia, composed of twelve young men, which has been active since its organization in 1930. We have had a fine letter from Harry Burke, secretary and treasurer of the club, telling us about their activities. Those interested in neighboring towns should address him at 1019 Logan St., McMechen, W. Va.

He states that the members of this organization have built, flown and dismantled a primary glider. They now have a secondary glider and a sailplane under construction and are planning on a lightplane as their next step. They have given us the above photo of the primary glider and the boys who built it.

The Mountaineers would like to get into correspondence with other clubs and exchange ideas with them.

END.

Fantome

(*Continued from page 286*)

the two blocks of the "vee" type liquid-cooled engine. By firing through the center of the propeller shaft, the necessity for complicated synchronizing gear is avoided. The use of the cannon is an alternative and it can be discarded by the substitution of two machine guns when so desired. With the cannon, two Browning machine guns are mounted in the center of the lower wing. Without the cannon, the two additional machine-guns are mounted in the top wing just above the engine. Four 22-pound bombs are carried in either case.

Thus, this plane has a great volume of fire toward the front, but all of it with rigidly mounted guns. All of the guns are operated through a single common sight arranged on the cowling directly in front of the pilot and are fired independently or together by triggers mounted on the stick. The master-cock for all guns is by a foot button.

Compressed air is used for starting the engine, for the brakes and for loading and firing the guns. The air is stored in a tank at the rear of the fuselage. Near the tank are the motor-generator and battery for the radio equipment, handled by remote control from the cockpit. The accessories are complete in every detail including tail-trim, shock-absorbers on both landing-gear and tail-skid, etc.

END.

USED AIRCRAFT FOR SALE

The ships listed below are located at various airports and are just a few of those which we have for sale. Upon request a list can be furnished of planes for sale at your nearest airport.

FAIRCHILD 71 — Wasp powered — on floats — fully equipped—ready to go—ideal for charter work. $5000

BELLANCA SKYROCKET—WASP C—470 hours total both on ship and engine—Ship recovered—standard instruments—new type landing gear perfect condition. $7000

CESSNA—J6 240—Total time 500 hours—Engine majored 150 hours back—good shape throughout—straightway compass—bank and turn—clock. $1400

COMMUTER—J6 300 D—350 hours total time—70 hours since major by factory—electric starter—generator—flares—bank and turn rate of climb—looks like new. $3000

FAIRCHILD 24—Warner 125—This is a demonstrator with a total time of 140 hours; beautiful condition—ring. $2300

LOCKHEED ORION—Majored F. I. B. I. 550 HP Wasp—new upholstery—radio—full blind flying instruments including gyro and horizon; cruises 200 MPH. Control pitch prop—interior can be arranged for four or six passengers—beautiful condition. $8000

FLEET—WARNER 125—500 hours total time—semi airwheels and brakes—standard equipment. $1000

MONOCOUPE—LAMBERT 90 DE LUXE—Demonstrator with a total of 24 hours—pants tunnel cowl—steel prop—flaps, etc. This is for the man in the market for a new airplane. $3000

MONOCOUPE LAMBERT 90—400 hours total—engine overhauled at 300 hours—blind flying instruments—ring—pants—starter—steel prop. Neat little job. $1600

PITCAIRN J5—Ship and engine majored recently—covering is perfect—full airwheels—standard instruments—privately owned. $1000

ROBIN CHALLENGER—550 hours total—in very good shape—standard equipment. Licensed for one year. $900

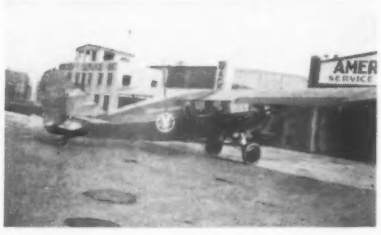
LOCKHEED VEGA—WASP C—Both ship and engine recently majored—all instruments including gyro and horizon—radio. $4000

SIKORSKY S-39—WASP JR. 350—total time 360 hours—engine majored at factory 47 hours each—ship was overhauled at factory at 321 hours; has had only one owner—3 new tires—full equipment—artificial horizon—life preservers—anchor—starter. $6000

STEARMAN J5—500 hours total—majored 150 hours back—licensed for one year—perfect condition. $950

TRAVELAIR 6000—J6 300—800 hours total—very good shape—wonderful ship for hopping at very low price. $1400

WACO—C—210 CONTINENTAL—Both engine and ship majored just few hours back—standard instruments—ring—pants. 1934. $3500



BELLANCA PACEMAKER—J6 300 E—Ship just recovered—165 hours total time on engine—radio—B & T—rate of climb—leather upholstery starter—pants—ring—The best in the country. $4500

SPECIALS

FLAMINGO—WASP B—All metal 3 place—special landing gear—excellent charter and short hopping special—installation for photographic work—apertures for Fairchild five minute camera—cruises 125 at sea level—135 at 8000 ft. Licensed one year. $4500

LAIRD—J6—300—Fastest sport plane in the East—privately owned and maintained—must be seen to be appreciated—cruises 150 MPH. Real low price for quick turnover. $1650

ROBIN—CHALLENGER—700 hours—125 hours since major on ship and motor. Real bargain price to move quickly. $950

FORD—J6 300—Tri motored—A1 shape throughout—instruments—new tires—real money maker. $5000

We will buy or sell any used aircraft which is in A1 condition. Send photograph and full information.

AVIATION PRODUCTS

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Flight Advisory Board

of the Boeing School of Aeronautics

CAN you think of any men better equipped to plan your flight instruction course than the pilots of "United"?

Addems . . . Williams . . . Lewis . . . veterans of line flying. The three executives who inspect and counsel the 150 pilots of the line that "flies more passengers, more planes, more mail, more miles, than any other line in the world."

Now their experience is *directly* at the service of the Boeing School.

As the members of the Boeing School Flight Advisory Board, it will be their duty to help keep flight instruction at the school even more closely co-ordinated with developments in the aviation industry itself.

And at graduation, they will personally interview and fly each Boeing School pilot for his final approval.

This supervision of Flight Courses supplements the actual training by the Boeing School corps of instructors headed by George Myers, Director of Flight Instruction, who was a veteran transcontinental mail pilot before assuming charge of Boeing flight training in 1929.

In every department of instruction, both flying and ground school courses, you benefit by this school's significant difference in purpose:

Boeing School, alone of all air schools, has been established and maintained by an airline to develop the type of trained men needed by the air industry.

That is why Boeing School is known for its long hours of intensive, serious work. And why the equipment and courses at Boeing School are *so much more complete.* At Boeing, you fly *bigger* ships. Even the primary training planes are heavier and of higher horsepower (165 h.p. to 210 h.p.) than those in use at certain other schools. And advanced flight training is given in transport-type ships of up to 1350 horsepower.

In the 9 shops and laboratories at Boeing you use standard airline equipment. You thoroughly learn 30 *modern radial engines* . . . use distillation apparatus, viscosimeters, oxidizers and centrifuges to investigate the characteristics of fuels and lubricants . . . make static and dynamic tests on airplanes for which ordinarily only an airplane factory is equipped . . .

Is it any wonder that when you graduate from Boeing, you are far better qualified than the average to earn your way to worthwhile jobs and promotion?

Under 18 full-time instructors, Boeing School offers a broad, complete range of 9 practical courses—ranging from a nine-month ground course at a tuition cost of $600 to the 24-month Boeing Airline Pilot and Operations course—tuition $5800—which totals 4015 hours of shop and apprentice work, lecture, airline operations, instrument and landing beam instruction, and dual and solo flying in 9 different types of planes.

Enrollment is restricted at Boeing School. If you are seriously interested in preparing for a worthwhile career in aviation, write today for full information and enrollment requirements. Rates from $600 upwards; courses from 9 months to 2 years, starting quarterly. Convenient payment plan. Mail coupon today.

• • •

BOEING SCHOOL OF AERONAUTICS
DIVISION OF UNITED AIR LINES

BOEING SCHOOL
FLIGHT ADVISORY BOARD

WALTER ADDEMS, chief pilot eastern division, United Air Lines. 16 years in aviation. 850,000 miles in the air.

WARREN D. WILLIAMS, chief pilot mid-western division, United Air Lines. 14 years in the industry, with a record of over a million air miles.

HAROLD T. LEWIS, chief pilot western division, United Air Lines. A pioneer of the Coast-to-Coast air mail. 20 years in the industry. A million miles in the air to his credit.

PLACEMENT

Boeing makes no promises of finding graduates jobs. It is a fact, nevertheless, that in 1933-34 the number of graduates to find placement equalled 84% of the number graduated in those years. And during the first 6 months of 1935, 80 graduates have secured positions.

NEXT REGULAR ENROLLMENT JANUARY 2

Boeing School of Aeronautics, Dept. H-11, Airport, Oakland, California

Gentlemen: I am interested in the courses indicated:

- ☐ Boeing Airline Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Private Pilot
- ☐ Amateur Pilot
- ☐ Airline Mechanic
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Cumulo-Nimbus

(*Continued from page 294*)

parently "rips the air" along the line of the flash or anything else that may be along this line. The color of these flashes may be dazzling white or bright blue-white, depending upon conditions. Immediately succeeding the flash comes the loud report that we call "thunder."

After the cloud front has been charged for some time, distributing flashes such as (L3) may be seen, carrying the high front potential to the nimbus clouds lying near the rear of the formation. As these flashes are mostly above the clouds and are therefore seen through water-vapor, they are red in color. Hence water vapor in thick masses absorbs all the colors but red, only the red light from the flashes (L3) can be seen. These horizontals or flashes are harmless because they do not reach the earth. Finally, after the storm has continued for some time, lightning strokes will appear at the center and rear of the nimbus cloud due to the fact that the distributing flashes have built up the potential to the striking point at the rear. The storm now becomes widespread over a larger area and the flashes have less intensity.

Very high potentials (we will not say voltages) are built up. They create a sufficient stress in the air to rip open from one-half to two miles of atmosphere. Call them electricity, ultra-violet light, heat vibrations or what you will, but nothing built by man can resist these potentials when placed on the direct path of the bolt.

Small side-flashes or branches from the main circuit, may work little damage, but when placed along the line of stress, the mechanical rupturing force is irresistible. Anything that lies along this path, a building, tree or airplane cannot be proof against this tremendous potential. The effect cannot be duplicated by high-tension electrical apparatus in a laboratory and the results of such small scale tests are misleading.

Crashing thunder, due to the flashes, rather indicates the nature of the discharge and the distance of the flash from the observer. The speed of the light may be taken as instantaneous, hence the lapse of time between the flash and the arrival of the thunder may be taken as representing the time required for the sound to travel through the air. This phenomena may be taken as a means for determining the distance of the flash from the observer. Thus, since sound travels through the air at speeds ranging from 1,050 to 1,200 feet per second, every five seconds elapsing between the flash and thunder represents one mile of distance. If we see the flash and then, 15 seconds later, hear the thunder, we know that the lightning is approximately three miles distant.

And now, let us look at the effect of lightning on an airplane at the back areas of the cloud where the wind has lost its violence and where hail no longer exists. We have airplane (1) directly in the line of stress so that the main discharge takes place through the plane to earth. The great amount of energy liberated through the thin skin of the plane and its frail structural members can be depended upon to vaporize these members and completely destroy the plane. If, however, the airplane (2) were out of the direct line of stress, and simply struck by a side-flash as shown (capacity flash), then there would be every prospect for the plane to pass through the ordeal uninjured and this has happened a number of times. The side-flash is simply proportional to the electrostatic capacity of the plane which is a comparatively small figure.

In general, there are six classes of lightning flashes that depend upon their form and upon local conditions. These are shown by Fig. 2 in six positions.

At (L1) is the straight heavy thick discharge known as the "bar" or "rod" flash that takes place in the front of a storm where the potentials are the highest and where generation is proceeding rapidly with high-velocity vertical currents. This is accompanied by a single heavy report like the deep boom of a cannon with very little rumbling. Anything in this line of stress is doomed for it represents the total discharge of the cloud.

At (L2) we have the thin rattling discharge called the "ribbon" discharge that takes place rather far back from the storm front, or from a comparatively small cloud area. The rattle is accompanied by a considerable number of echoes occupying a brief length of time. This discharge can be conducted by

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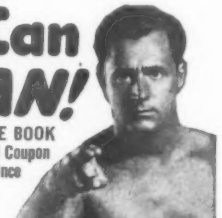

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lightning rods or other small conductors, and is therefore not so dangerous as (L1).

At (L3) is an example of "loop" lightning, common with storms that are nearly exhausted or accompanied by irregular and intermittent rainfall. This is accountable for the long rolling rumble often experienced with small clouds. The reason for the rolling rumble is the irregular form and nodes, located at varying distances from the observer. Like ribbon lightning, this loop discharge is easily conducted by lightning rods or other small conductors.

The "tree" lightning flash in (L4) is a comparatively straight main flash with many side-flashes or branches along its length, and because of the dissipation of energy by the side-flashes, the main flash often falls short of reaching the ground. The flash is accompanied by rattling crackling thunder that jars the windows and causes much vibration.

Duplex or ionized flashes show on a photographic plate much like the flash at (L5), where a faint ionizing flash (a) ionizes the air and water-vapor and paves the way for the heavy crashing main discharge (b). Rotating camera photos show that the discharge (a) is progressive, that is, slowly travels down until its length is completed.

The horizontal flash (L6), that takes place from cloud to cloud, distributing the potential evenly over all of the adjacent clouds, is productive of prolonged rattling thunder that echoes and reverberates from cloud to cloud for several seconds at a time. It is perfectly harmless unless it overcharges an adjacent cloud, thus causing an intense vertical stroke similar to that at (L1).

For example, if (L1) were charged up until just ready to strike and then at that moment, (L6) should overcharge the cloud, then the total contents of both clouds would discharge to earth along (L1) causing a heavy dangerous discharge. As (L6) is generally above the clouds, and is seen from earth through this water-vapor, the flash usually is of a reddish color.

Thunderstorms move at a speed of about 30 m.p.h. in the case of mild storms or about 40 m.p.h. with severe storms accompanied with incessant lightning. They are comparatively small, averaging from 10 miles to 50 miles wide across the front and about 20 miles deep in the direction of motion. Even when the front is 50 miles wide it is usually possible to find a clear open space to fly through, a proceeding that is safer than to attempt flying over the cloud. In most cases, they move from the southwest to the northeast in central United States and the thunderstorm frequency averages very nearly constant each year for each district in regard to the number of days with thunderstorms. The average life of a thunderstorm is short, from six to eight hours before it finally breaks down into a gentle rain.

The number of days per year with thunderstorms will average from 10 to over 90 days, depending upon the location. The following table gives the average number of days with thunderstorms.

Thunder Storm Frequency

STATES	AVERAGE NO. DAYS WITH STORMS
California, Oregon, Washington, W. Nevada, Maine, W. Idaho	10-15
Montana, E. Idaho, N. Wyoming, N. Dakota, S. Dakota, Minnesota, Wisconsin, W. Texas, S. Arizona, Massachusetts, New York, Vermont	16-40
Illinois, Iowa, Missouri, Nebraska, Kansas, Oklahoma, E. Texas, Arkansas, W. Louisiana, Indiana, Kentucky, Ohio, W. Virginia, N. Carolina, S. Carolina	40-60
E. Louisiana, Mississippi, Tennessee, N. Alabama, N. Georgia, E. Florida	60-80
W. Florida, S. Alabama, S. Georgia.	80-100

In the central portion of the United States, thunderstorms usually make their first appearance in March and gradually increase in number and intensity until the first of July, reaching the peak in June. There is a rapid decrease during August, a few in September and only a very few in November and December,

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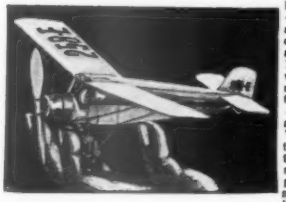

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The World's Planes and Builders

(Continued from page 302)

MANUFACTURER	PLANE SYMBOLS	DESCRIPTION
ENGLAND CONTINUED		
Arrow Aircraft (Leeds), Ltd., Little Russell Street, Leeds.	Arrow "Active II".	1-seat light biplane for military training and sporting purposes.
The Cierva Autogiro Co., Ltd., Bush House, Aldwych, London, W. C. 2.	Cierva Autogiro Type C. 30.	2-seat autogiro.
A. V. Roe & Co., Ltd., Newton Heath, Manchester.	Avro "Tutor".	2-seat training biplane.
	Avro "Seatutor".	Identical with the landplane except for float gear.
	Avro 626.	2-seat advanced training biplane.
	Avro 626 Seaplane.	Seaplane conversion of the Avro 626.
	Avro 637.	Developed from Avro 626.
	Avro "Cadet".	2-seat training biplane.
	Avro "Cadet" Seaplane.	Seaplane form of "Cadet".
	Avro "Commodore".	4-seat cabin biplane.
	Avro 642.	Twin or four-engine cabin monoplane.
	Avro 652.	Twin-engine cabin monoplane.
	Avro 660.	Twin-engine cabin monoplane.
B. A. C., Ltd., London Air Park, Feltham, Middlesex.	B.A.C. "Drone".	Single-seat sport monoplane.
The Blackburn Aeroplane & Motor Co., Brough, E. Yorks.	Blackburn B-2 Trainer.	2-seat light training biplane with side-by-side seating.
	Blackburn B.2 Tourer.	Conversion of the Blackburn B-2, for the private owner.
	Blackburn "Baffin".	2-seat torpedo-bomber.
	Blackburn "Shark".	2 or 3-seat torpedo bomber.
	Blackburn "Perth".	3-engine coastal patrol flying-boat.
Boulton & Paul Aircraft, Ltd., Riverside Works, Norwich.	Boulton & Paul "Sidestrand III".	Twin-engined day bomber.
	Boulton & Paul "Overstrand".	Similar to "Sidestrand" but carries twice the bomb load.
	Boulton & Paul P.71A.	Passenger-carrying plane. Has accommodation for six or seven passengers.
The Bristol Aeroplane Co., Ltd., Filton, Bristol.	Bristol "Bulldog" MK.11A.	1-seat fighter biplane.
	2-Seat Bristol "Bulldog T".	2-seat biplane for advanced training.
	Bristol "Bulldog" MK.IV.	1-seat high-performance fighter.
	Bristol 120.	2-seat general-purpose biplane.
The De Havilland Aircraft Co., Ltd., Hatfield, Herts.	D.H. 60 "Moth-Major".	2-seat sport or training biplane.
	D.H. 82 "Tiger-Moth".	2-seat military training biplane.
	D.H. 84 "Dragon".	2-engined cabin biplane.
	D.H. 85 "Leopard-Moth".	3-seat cabin monoplane.
	D.H. "Hornet-Moth".	3-seat cabin monoplane.
	D.H. 86 "Express Air Liner".	4-engine passenger, mail and freight carrier.
	D.H. 89 "Dragon-Six".	Twin-engine express, passenger, or freight-carrier.
	D.H. 88 "Comet".	Twin-engined long-range racing monoplane.
The Fairey Aviation Co., Ltd. Hayes, Middlesex.	Fairey "Gordon".	2-seat medium-range day bomber.
	Fairey "Seal".	The Fleet conversion of the "Gordon" day bomber.
	Fairey "Hendon".	Twin-engined night-bomber.
	Fairey T.S.R. Biplane.	Three-purpose naval aeroplane.
	Fairey General Purposes Biplane.	General purpose biplane.
	Fairey "Fox" Mk. II.M.	2-seat day bomber.
	Fairey "Fox" Mk. III.M.	Similar to the Mk. II, except for two belt-fed guns firing forward through the propeller.
	Fairey "Fox" Mk. IV.M.	Similar to the Mk. III, except for float undercarriage.
	Fairey "Fox" Mk. V.M.	Long-range high-performance single-seat fighter.
	Fairey "Firefly" Mk. II.M.	1-seat high-performance fighter.
	Fairey "Firefly" Mk. III.M.	1-seat fighter ship-plane.
The Gloster Aircraft Co., Ltd., Hucclecote, Glos.	Gloster "Gauntlet".	1-seat high-altitude fighter.
	Gloster F.7/30.	4-gun 1-seat fighter biplane.
Handley Page, Ltd., Cricklewood, London, N. W. 2.	Handley Page 42, Types "Hannibal" and "Heracles".	4-engine passenger air-liner.
	Handley Page "Heyford" MK. I.	Twin-engine long-range "Express" night-bomber.
	Handley Page "Heyford" MK. II.	Twin-engined, long-range "Express" night-bomber.

(Continued on page 328)

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The World's Planes and Builders

(Continued from page 326)

MANUFACTURER	PLANE SYMBOLS	DESCRIPTION
ENGLAND CONTINUED		
Hawker Aircraft, Ltd., Kingston-On-Thames, Surrey.	Hawker "Hart".	1-engine day bomber.
	Hawker "Hart" Trainer.	Adaptation of day bomber type.
	Hawker "Hardy".	2-seat general purpose biplane.
	Hawker "Hind".	Latest version of the "Hart".
	Hawker "Osprey".	2-seat Fleet Fighter Reconnaissance biplane.
	Hawker "Audax".	2-seat Army Co-operation biplane.
	Hawker "Demon".	2-seat fighter version of the "Hart".
	Hawker "Fury".	1-seat interceptor fighter and deck-landing fighter.
	Hawker "Nimrod".	Fleet Air Arm version of the "Fury".
	Hawker "Super-Fury".	1-seat fighter.
	Hawker F7/30.	1-seat Day and Night Fighter.
The Hendy Aircraft Company, 7, Park Lane, London, W. 1.	Hendy "Heck".	2-seat high-performance cabin monoplane.
The British Klemm Aeroplane Co., Ltd., Hanworth Aerodrome, Feltham, Middlesex.	British Klemm "Swallow".	2-seat lightplane with open cockpits.
	British Klemm "Eagle".	3-seat cabin monoplane.
Phillips & Powis Aircraft (Reading), Ltd., Woodley Aerodrome, Reading.	Miles "Hawk".	2-seat light training monoplane.
	Miles "Colonial Hawk".	2-seat light training monoplane.
	Miles "Three-Seat Hawk".	3-seat light training monoplane.
	Miles "Hawk-Major".	2-seat lightplane with wide speed-range.
	Miles "Falcon".	3 or 4-seat version of the "Hawk-Major".
General Aircraft, Ltd., The London Air Park, Feltham, Middlesex.	Monospar ST. 4.	4-seat general-purpose twin-engined monoplane.
	Monospar ST. 10.	Improved version of the Monospar ST.4.
	Monospar ST. 11.	4-seat general-purpose twin-engined monoplane.
Percival Aircraft Company, 20, Grosvenor Place, London, S. W. 1.	Percival "Gull".	3-seat cabin monoplane.
	Percival "Mew Gull".	1-seat high-speed monoplane.
Saunders-Roe, Ltd., East Cowes, Isle of Wight.	Saro "Cutty Sark".	4-seat cabin flying-boat.
	Saro "Cloud" (Civil Type).	8-seat cabin amphibian.
	Saro "Cloud" (Military Type).	Similar to Civil Type.
	Saro A.27.	Twin-engined open-sea observation flying-boat.
Short Bros. (Rochester & Bedford), Ltd., 41, Whitehall, London, S. W. 1.	Short R.6/28.	6-engine flying-boat.
	Short R.24/31.	Twin-engined general purposes flying-boat.
	Short "Rangoon".	3-engine long-range observation flying-boat.
	Short "Scipio".	4-engine 15-passenger flying-boat.
	Short "Scylla".	4-engine airliner using superstructure of the Short "Scipio".
	Short "Singapore III".	4-engine observation and coastal patrol flying-boat.
	Short "Scion".	Twin-engine light transport monoplane.
Spartan Aircraft, Ltd., Cowes, Isle of Wight.	Spartan "Cruiser" Mk.II.	6-10-seat commercial monoplane.
	Spartan "Cruiser" Mk.III.	Improved Spartan "Cruiser" II.
The Supermarine Aviation Works (Vickers), Ltd., Woolston and Hythe, Southampton.	Supermarine "Scapa".	Twin-engine open-sea observation flying-boat.
	Supermarine "Seagull V".	Single-engine fleet-spotter amphibian.
	Supermarine "Spitfire".	1-seat day and night fighter monoplane.
The De Havilland Aeronautical Technical School, Stag Lane, Edgware, Middlesex.	T.K. 1.	2-seater touring or training biplane.
Vickers (Aviation), Ltd., Byfleet Road, Weybridge, Surrey.	Vickers "Vildebeest".	1-engine torpedo and bombing biplane.
	Vickers "Vildebeest III".	Structurally similar to the "Vincent", but equipped as a torpedo-bomber.
	Vickers "Vincent".	General purpose plane similar to "Vildebeest".
	Vickers "Virginia".	The standard heavy-weight bombing machine in the Royal Air Force for several years.
	Vickers "Vellox".	Twin-tractor biplane-landplane, convertible to floatplane.
	Vickers "Valentia".	2-engine troop-carrier.
The Westland Aircraft Works (Branch of Petters, Ltd.), Yeovil, Somerset.	Westland "Wallace".	2-seat general-purpose landplane or seaplane.
	"Houston-Westland".	2-seat biplane.
	Westland P.V.7.	2-seat general purpose.

XUM

MANUFACTURER	PLANE SYMBOLS	DESCRIPTION
FINLAND		
Valtion Lentokonetehdas (The State Aircraft Factory), Suomenlinna and Santahamina, Helsinki (Helsingfors).	(No data released)	Military aircraft.
Osakeyhtio Sääski, 12, Bulevardi, Helsinki.	Sääski II Biplane.	2-seat light biplane.
FRANCE		
Société D'Emboutissage Et De Constructions Mecaniques, 171-183 Boulevard Du Havre, Colombes (Seine).	Amiot 123-Bp.3.	3-seat single-engined bombardment biplane.
	Amiot 142-M.	Twin-engined multi-seat fighter, bomber or long-distance observation monoplane.
Société Des Avions Bernard, 67, Rue De La Convention, La Courneuve (Seine).	Bernard 52-C1.	1-seat fighter seaplane.
	Bernard 75-C1.	1-seat light fighter monoplane.
	Bernard 160.	3-engine monoplane.
	Bernard 260-C1.	High-performance 1-seat fighter monoplane.
Blériot-Aéronautique, 1-7, Quai Gallieni, Suresnes (Seine).	Blériot 110.	1-engine monoplane for racing.
	Blériot-Spad 510.	1-seat high-altitude fighter.
Avions Marcel Bloch, Quai Paul-Doumer, Courbevoie (Seine).	Blériot 5190.	4-engine long-range flying-boat.
	Marcel Bloch 81.	1-engine ambulance monoplane.
	Marcel Bloch 141.	2-seat cabin monoplane adapted from the type 81.
Société Aérienne Bordelaise, 6, Rue De Villersexel, Paris.	Marcel Bloch 200. BN.4.	High-speed bomber.
	Bordelaise A.B. 20 and A.B. 21.	4-engine military monoplane.
	Bordelaise A B. 80.	2-engine multi-seat military monoplane.
	Bordelaise L.H. 70.	3-engine all-metal Colonial monoplane.
	S.E.M.A. 10.	2-seat biplane equipped for the complete training of military pilots.
Société Anonyme Des Ateliers D'Aviation Louis Breguet, 24, Rue Georges-Bizet, Paris (XVIme).	Breguet 19-8 and 19-9.	2-seat general purpose military biplane.
	Breguet 27.	2-seat observation (A.2) sesquiplane.
	Breguet 27-3 and 27-4.	For long-distance observation or long-distance bombing. Fitted with the 700 h.p. Gnôme-Rhône.
	Breguet 41-3 and 41-4.	Twin-engined multi-place fighter.
	Breguet 39T Biplane.	3-engine commercial biplane.
	Breguet "Bizerte".	3-engine open-sea reconnaissance flying-boat.
	Breguet "Saigon".	Long-range flying-boat.
	Breguet 660.	Twin-engined bomber or multi-seat fighter monoplane.
	Breguet 670.	Twin-engined 18-passenger commercial monoplane.
Chantiers Aéro-Maritimes De La Seine, Quai Pierre-Brunel, Sartrouville (S. et O.).	C.A.M.S. 37^2 and 37^3.	3-seat bombing or coastal observation flying-boat or amphibian (37^3).
	C A.M.S. 37^{11}.	Modification of the type described above.
	C.A.M.S. 55^3.	2-engine bombardment or observation flying-boat.
	C.A.M.S. 55^6 and 55^{11}.	Similar to the 55^3 except that they are fitted with air-cooled radial engines.
Avions Caudron, 52-72, Rue Guynemer, Issy-Les-Moulineaux (Seine).	Caudron C 272-3 "Luciole".	2-seat light biplane.
	Caudron C 282-8 "Phalene VIII".	4-seat light cabin monoplane.
	Caudron 360.	Monoplane.
	Caudron C.366 "Atalante".	Modification of the original Caudron "Atalante".
	Caudron C.440.	Twin-engined low-wing cabin monoplane.
	Caudron 450.	1-seat racing monoplane.
	Caudron C.460.	1-seat racing monoplane.
	Caudron C.530 "Rafale".	2-seat high performance light monoplane.
Société Des Avions Réné Couzinet, 3-5, Boulevard de Levallois-Prolonge, Ile De La Grande Jatte, Lavallois-Perret (Seine).	Couzinet 101.	Light 3-engine 3-seat cabin monoplane.
	Couzinet 70 "Arc-En-Ciel".	3-engine commercial monoplane.
	Couzinet 110.	3-engine passenger-carrying or touring monoplane.
Société Aéronautique Francaise, 66, Rue Boissiere, Paris, XVIe.	Dewoitine D-500.	1-seat high-altitude fighter.
	Dewoitine D-520.	1-seat high-altitude fighter.
	Dewoitine D-371.	1-seat fighter.
	Dewoitine D-331.	Military development of the "Trait D'Union".
	Dewoitine D-333.	3-engine commercial monoplane.
	Dewoitine D-334.	Similar to D-333 except that it is arranged to accommodate 30 passengers.

(*Continued on page 331*)

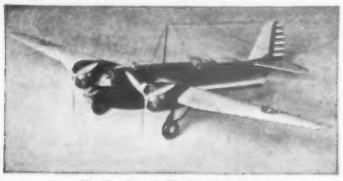
XUM

CURTISS GOSHAWK F11C-2
Span 23⅝", length 16⅝". Marvelous model. Green, pearl gray, black details. Kit SF-49 **$3.75**

Beautiful Fokker D-7 Fighter
Span 21¼", length 17". Rich in details. Orange, green, white, black details. Kit SF-15. **$2.95**

2-place Vought Corsair V-65
Span 26⅞", length 19⅝". Super detailed. Beautiful flights. Blue, yellow, red, black and silver. Kit SF-41..... **$3.75**

'33 Air Race Winner—Wedell's W-Williams
Span 19½", length 16⅝". Very beautiful in appearance and flights. Red, black and bronze. Kit SF-47..... **$2.95**



U. S. Army Martin Bomber
Span 53⅛", length 33⅛". Nothing ever before like it. Novel and strong method of duplicating an almost impossible landing gear (but not retractable—however it may be done). Turned balsa invisible hub wheels. Colored standard U. S. Army yellow, olive drab, details black. A real Kit. Kit SF-45..... **$8.50**

'34 Air Race Winner Turner's W-Williams
Span 19½", length 16⅝". Roscoe Turner's plane. Fast flying. Wedell-Williams gold. Kit SF-48 ..... **$2.95**

Hawker Highspeed Fury Fighter
Span 22¼", length 19½". Redesigned. Long fast flights. All silver and blue trim. Kit SF-20..... **$2.65**

'30 Air Race Winner—Laird Solution
Span 15⅞", length 13⅝". A fast flier. Pretty lines. Unusually realistic. Gold and black. Kit SF-46..... **$2.50**

Douglas O-38 Observation
Span 30½", length 22¾". Very beautiful, and unusually well detailed. Yellow, olive drab, black. Kit SF-43..... **$3.75**

Famous Travel Air Mystery Ship
Span 21¾", length 14⅞". Swift flier. Rich in detail. Red, black scalloping, green trim. Kit SF-2..... **$2.95**

U. S. Army Hawk P6E Fighter
Span 23⅝", length 16⅝". Most authentic Hawk on the market. Yellow, olive drab. Selfridge Field markings. Kit SF-21..... **$3.25**

"DWARFS" OF ABOVE MODELS (½")
in complete Kit form (except NO LIQUIDS) with dimensions 2/3 size: Curtiss Goshawk, 85c; Fokker D-7, 60c; Vought Corsair, 85c; Wedell's W-Wms, 50c; Martin Bomber, $2.50; Turner's W-Wms, 50c; Hawker Fury, 45c; Laird Solution, 50c; Douglas 0-38, 85c; Travel Air Mystery, 50c; Hawk P6-E, 75c. Add 10c PER KIT for packing charge if less than 6 are ordered.

See Your Dealer if he can't supply you, order direct. No C. O. D.'s. Canada, Mexico, British Isles add 10% to above prices; other countries, 20%. DEALERS—CLUBS—send for discount sheets and entirely new merchandising plan. New Boxes, etc.

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MODEL & SUPPLY CO., Inc.
1866PAL West 57th St., Cleveland Ohio, U.S.A.

Les Long

(Continued from page 282)

pendulum stability, the parasol undoubtedly has it. In all normal flight it is of no value, but there might come a time when it would be valuable. This writer once saw a lightship completely lose flying speed and parachute straight down 60 feet to the ground. Nothing happened, except that the landing-gear came up through the floor boards and the pilot felt as though he had been severely spanked.

It is just possible, that in this case, the low-wing might have capsized. If it had, the pilot would probably have gone through the floor boards, instead of the landing-gear doing it and he might not have felt so good about it. The risk of such an accident is certainly remote although it just as certainly exists.

Nothing has yet been said about the midwing. By "midwing" is meant the type with the wing attached to the top longerons. In this writer's opinion the midwing is not a practical lightplane. It has all the bad features of the other types, with the good features of neither. The lift is poor, the vision bad and the bracing angle ditto, unless the bracing is attached to the landing gear. The scarcity of the midwing seems to bear out these statements. However, there are many who like this design and it no doubt has possibilities.

A few words about the planes might be of interest. All ships had 30 foot span, except the Hi-Low which has a 32 foot span. The chord was 50 inches in all cases. Wheels were Airwheels, size, 16-7-3. Construction was standard, of spruce, steel and fabric. Weights varied from 320 to 350 pounds, empty.

Highest speed was made by the wire-braced low-wing, 80 mph. As stated, it also had the lowest landing speed, 25 m.p.h., a speed range of more than 3 to 1. The Hi-Low had the most striking appearance, looking like a great sea-gull and it is safe to say that when built as a cantilever it has quite a future before it.

The whole problem might be summed up about this way. The low-wing is faster, lighter, better looking and easier to enter or leave. It has the better speed range and handles better on the ground. The parasol has the steepest climb, spins slower, has better bracing arrangement and has a certain amount of pendulum stability. On the whole, the low-wing has the best of it.

The amateur builder can choose either type with confidence. If he already has a preference, that makes it simple. If he doesn't, the above may help him to choose. For the builder who has had very little or no experience, the parasol is probably the safest. There are no particular balancing difficulties and there are no critical fillet problems to solve. The chances are that, if the low-wing is built, several different sets of wing fillets will have to be tried before the ship is free from quick stalling and tail flutter. About the only way filleting can be made right is to go by the trial and error method.

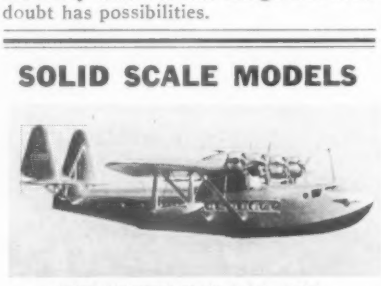
Practical experiments of this type takes time, cost a lot of money and stand for a lot of hard work, but the experimenter has a lot of fun and gets a lot of kick out of the job in addition to really learning something that is not between the covers of text-books.

If a number of experienced lightplane fans could be grouped together for such work, each with a different problem to solve so that there would be no duplication, a tremendous amount of data could be obtained that would promote the interests of aviation.

This building and flying of light airplanes is one of the most fascinating and instructive of all sports. If the builder and flyer attends some good flying school and wins his pilot's license, there is very little danger in it. Perhaps better days will come, when instead of being squelched and shunted out of the way, the young people of America will be helped and advised by a benign and more tolerant Government. If such should come to pass there is no limit to the growth of amateur aviation.

END.

SOLID SCALE MODELS



Actual Photograph of the D.E.L. Model SIKORSKY "CLIPPER" S-42 Span 17¾"

Kit contains semi-cut balsa hull, bored bass port hole stripe, semi-shape balsa wing, outline tail surfaces, floats, cabane, poplar turned nacelles, bass struts, metal cast propellers, motor plates, lacquered motors and numerals sheet, reed, celluloid, sandpaper, etc. 1 oz. silver dope, 1 oz. silver undercoat, 3 dr. black dope, ⅛ oz. glue, pkg. of wood filler, full size 3-view drawings with complete instructions.

Postpaid $1.75

Span 17¾"	Martin Bomber	$2.00
Span 13¾"	Boeing 247 Transport	1.25
Span 12"	Heli Diver	1.25
Span 12"	Spad XIII	1.50
Span 12"	Fokker D VII	1.00
Span 10⅝"	Lockheed Orion	.65
Span 8"	Laird 400	.50
Span 12½"	Los Angeles Dirigible with metal cast base and turned hull	1.25

Each Kit contains everything required to make a complete Model. Kits are sent prepaid and insured. Send 3c stamp for illustrated folder. Ask your Dealer: If not obtainable, order direct. West of Denver, Colo., 25c extra. Canadian Prices 40% higher to cover duty. Remit cash by Money Order. No stamps. No C.O.D.'s.

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FREE AVIATION TRAINING

Amateur Pilot Course

THREE MONTHS' COURSE CONSISTING OF CLASSROOM LECTURES, ACTUAL WORK ON AIRCRAFT, AND TEN HOURS FLIGHT INSTRUCTION WITH TRANSPORT PILOT. ROOM AND BOARD ARRANGED. TRANSPORTATION BY PLANE. HONOR GRADUATE WINS COMMERCIAL COURSE IN APPROVED AIR COLLEGE. THIS COURSE IS ABSOLUTELY FREE. INFORMATION FOR 10c OR ILLUSTRATED BOOKLET FOR 20c. YOUNG MEN AND WOMEN WRITE TODAY. NATIONAL COLLEGE OF AVIATION, NEW YORK CITY. DEPT. A.

An Airy Chat with the Editor

(Continued from page 278)

equipped with a converted Henry or Harley-Davidson kicker.

* * *

LES LONG has written many fine lightplane stories for P. A., but we believe that his story in this issue is by far the best that he has ever written. It is full of real practical information for the lightplane fan and builder and is the result of actual experience with planes built by Mr. Long. This story is worth a lot to any intending builder.

* * *

WHAT ABOUT that hangar story that we asked you to send in? So far, we have had no replies from amateur hangar builders, except from one guy who evidently has something to sell. It certainly seems likely that some of you fellows must have constructed a fine hangar for less than $100. Why hold out on us—tell us how to do it.

* * *

THERE seems to be a lot of interest in tailless arrow-planes at present. The Arup started the craze about three years ago and now they are springing up all over this country and in Europe. The Waterman is one of the latest tailless ships in the U. S. A. and you will find a full description of it in this issue. It seems strange that William Stout is not getting in on this flying-wing game. He certainly has a good patent.

* * *

BECAUSE of the requests from many readers, we intend to have the lettering placed on the front cover to a position where it will not obscure nor deface the cover illustration. All type matter will be placed either above or below the illustration in the December issue, and in succeeding issues if the idea proves successful.

We have had this matter under consideration for some time, but a request by R. E. C. Lord, Red Deer, Alta., Canada, a General Motors dealer in that territory, precipitated our decision. With the cover free from type matter, the arrangement will be ideal for our cover fans who value these paintings. We will be glad to receive comments on this change from our readers or any further suggestions that they wish to make.

* * *

DEAR AUTHORS: Just before you slip that manuscript into the envelope, please see whether your name and address is attached. We are not psychic in this joint and, unless you plainly mark your name and address, we will have a great deal of trouble finding out who is responsible for the contribution. Of course, we can photograph the finger-prints around the edge of the sheet and send them to the Bureau of Identification in Washington, but this will not do a great deal of good either unless he or she has committed some major crime and on record.

* * *

ONCE UPON A TIME, there was a finger-print school in Chicago that applied the above principle to their correspondence. The student would sign his correspondence and answers to his lessons only by his thumb prints. The instructor, in reply, would sign with his thumb prints, thus making a practical test of the system. Now, while this is perfectly satisfactory for a school of this sort, it is not such a hot method in corresponding with authors, artists and photographers.

* * *

OUR engine expert, Mr. Glenn D. Angle, questioned the attitude of the Aubier-Dunne lightplane engine on page 174 of the September issue. He claims that this is an inverted type engine, hence with the cylinders above the crankshaft as shown, it is upside down. But, if the picture is upside down, then the engine cannot be right-side up in real life unless it is upside down, and the picture being right side up is really upside down . . . . . well, you get what we mean.

* * *

WELL, we were in hope of getting some thrilling news out of the Macon disaster investigation, but it all dried up and blew away as usual. We were living in hope that this beam of light would extend as far as the City of Akron, Ohio, where they build collapsible stratospheric balloons as well as folding type dirigibles, but that was too much to expect. Anyhow, they didn't make a goat of the Navy personnel.

* * *

BUSINESS OPPORTUNITY: We believe that there would be a good opportunity for a night school in Akron where stress analysis and strength of materials would be taught. Besides all the ripping and cracking that comes from there, I also beg to announce that my right rear tire ain't so healthy either.

So long. J. B. R.

The World's Planes and Builders

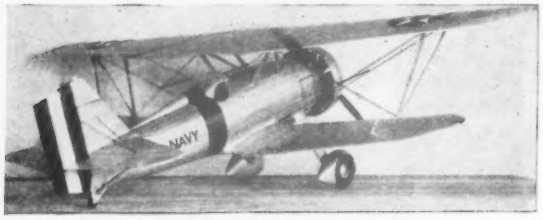
(Continued from page 328)

MANUFACTURER	PLANE SYMBOL	DESCRIPTION
	Dewoitine D-335.	Similar to the D-333 except that the cabin is arranged to accommodate 20 passengers.
	Dewoitine D-420.	Middle-wing cantilever monoplane designed as a multi-seat fighter.
	Dewoitine D-430.	3-engine colonial monoplane.
Avions Henri Et Maurice Farman, 167, Rue De Silly, Billancourt (Seine).	Farman F-221.	4-engine night-bomber.
	Farman F-270.	Twin-engined bombing seaplane.
	Farman F-402.	3-seat cabin monoplane.
	Farman F-430.	5-passenger twin-engine cabin monoplane.
Compagnie Des Avions Hanriot, 1, Route D'Orleans, Arcueil (Seine).	Hanriot H-12 to H-16.	2-seat training and general-purpose monoplane.
	Hanriot H-110. C1.	1-seat pusher fighter.
	Hanriot H-130.	1-seat fighter monoplane.
La Société Industrielle D'Aviation Latécoére, 79, Avenue Marceau, Paris.	Latécoére 29-0.	1-engine torpedo landplane or seaplane.
	Latécoére 30-1.	4-engine long-range postal flying boat for trans-Atlantic service.
	Latécoére 38-0.	Twin-engined postal flying-boat.
	Latécoére 38-1.	Twin-engined long-distance observation flying boat.
	Latécoére 49-1.	2-seat long-range reconnaissance monoplane.
	Latécoére 50-0.	3-engine postal flying-boat.
	Latécoére 50-1.	3-engine commercial flying-boat.

(To be continued in the next issue)

XUM

NEW CURTISS F11C4 NAVY PURSUIT



28" Span, Length 20½", Weight 4 oz., 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3⅜" celluloid, 700 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheels pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set Complete, postpaid..... $4.50

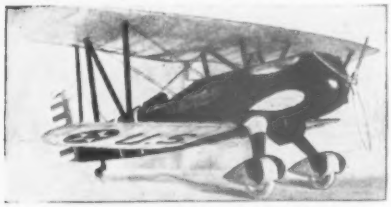
NEW LOCKHEED P23A NAVY FIGHTER

COMBINATION LAND AND SEA PLANE SET

32" Span. Length 22½". Weight 3½ oz. ¾" Scale.

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop, 3 oz. silver paint, 1 oz. cement, 2 oz. glue, large 33"x14" drawing.
Construction set in labeled gift box, complete, postpaid..... $2.95

CURTISS ARMY HAWK P6E

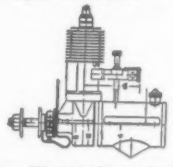


24" Span, Weight 2¼ oz., Flies 600 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, printed instrument board, 8" carved propeller.
Construction Set Complete, postpaid..... $2.50

1/5 H. P. Gasoline Model Motor

Weight As Shown 8 oz.



Long life motor has steel cylinder and piston. ⅞" bore x 1" stroke. Comes complete with gas tank, coil, condenser, batteries. Price ready to run, complete, postpaid. Only **$22.50**

15" or 19" laminated prop, for motor **$2.75**

MONEY ORDERS: Issue to Staten Island, N. Y., Post Office

NEW DOUGLAS O45A ARMY FIGHTER

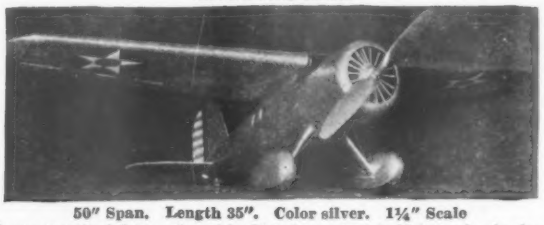
38" Span. Length 28". Weight 4½ oz. Color Blue and Yellow

A beautiful large ¾" scale model of one of the latest army planes, capable of long flights. Set contains all parts printed on balsa, 2¼" turned wheels, windshields, colored insignia, U. S. Army lettering, 2 oz. yellow paint, 1 oz. blue, 1 oz. clear, 2 oz. glue, etc., 24 nickel plated hollow exhaust pipes, a 10" carved scale 2 bladed prop, and full sized scale drawing, 33x44. Model has a removable motor box, and can win almost any flight contest.
Cons'ruction Set complete, postpaid..... $3.50

NEW 1935 CATALOGUE. Send 3 cent stamp.

NEW LOCKHEED ARMY SPEED VEGA

All Parts Ready Cut Out



50" Span. Length 35". Color silver. 1¼" Scale

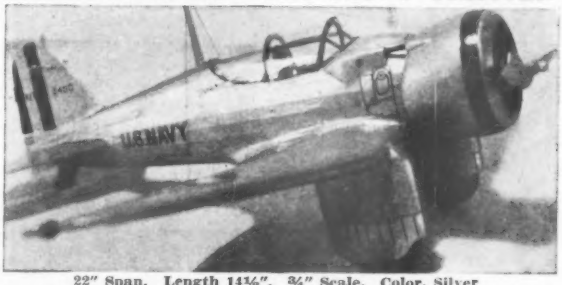
A new sensational flying scale model. Rises from ground in 15 feet and makes long steady flights. Const. set contains all formers and wing ribs cut out and notched for stringers, spars, etc., wheel pants ready cut, 3" turned balsa wheels, 5⅝" turned balsa cowl front, 15" carved varnished steel type propeller shown, 3 oz. silver paint, glue, etc. Even an amateur can make a perfect model of this with ease.
Construction Set, postpaid..... $8.50

NEW BOEING F4B4 NAVY FIGHTER

22½" Span. Length 14½", Weight 2½ oz., Color, Silver and Yellow

New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia and ¾" scale drawing. Construction Set Complete, postpaid. **$2.95**

NEW NORTHROP FT1 NAVY FIGHTER



22" Span. Length 14½". ¾" Scale. Color, Silver

An exact scale model of the world's fastest fighter, 285 m.p.h. Set includes all parts printed on balsa, a 3" turned cowl front with bearing button, windshields, colored insignia, rubber, 2 oz. silver paint, 1 oz. clear, 1 oz. glue, ½ oz. black for striping, semi-scale flying prop, sandpaper, full size scale drawing, and all parts to build as shown.
Construction Set in labeled box, postpaid..... $2.00

BOEING F4B4 NAVY PURSUIT

1/5 H.P. Gasoline Motor Driven Model

68" Span. Length 44". 2¼" Scale. Color Silver

This is not just an ordinary large model, but one specially designed and engineered to stand the strain of the gas motor. The most realistic and life-like model of this size ever produced. As all the fuselage formers, wing ribs, tips, etc., are all cut out and notched for stringers, spars, etc., even a novice can make a perfect model of it with ease. Set contains 6" turned balsa wheels with bearings, rubber tail wheel, a special turned balsa 10" speed, cowl ring used on the latest Boeings, silk covering material, silver and red dope, glue, full size scale drawing, axles; all wood cut to size, etc. Weight of model with motor 3½ lbs.
Construction Set Complete, without motor, postpaid..... $25.00

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

Our Readers

(*Continued from page* 309)

fully estimated the climb at 1,000 feet per minute and in a comparative test it easily outclimbed a Kinner powered Fleet and nearly equalled the Fleet in top speed. The little Salmson handles the ship nicely at 1,500 r.p.m. and turns at 2,200 at full throttle.

SPECIFICATIONS OF BARNES LIGHTPLANE

Wing span	29'-6"
Chord of wing	52"
Wing area	120 sq. ft.
Length overall	16'-9"
Weight empty	450 lbs.
Useful load	240 lbs.
Power loading	17.25 lbs.

The construction is of the conventional type, with the fuselage, tail-group and ailerons of welded steel tubing and wing-spars of solid spruce. In spite of the relatively short fuselage, the elevator and rudder control are said to be excellent. The length of the lever arm between the center of gravity and the elevator hinges is 2.5 times the chord.

Among the usual features for an amateur ship are the hydraulic shock-absorber struts in the landing-gear and the adjustable outer wing struts which can be adjusted for rigging. The oleo struts are of original design, requiring no compressed air, springs nor rubber discs. Landing shock is absorbed without any tendency toward bouncing and once on the ground, the absorber is out of action until the next takeoff.

The Salmson engine, by the way, was secured through P. A.'s Barter and Exchange Department. They are pleased with the motor and believe they got a good buy. Mr. Barnes very quaintly remarks that the next time he makes a drawing of a lightplane he'll use a two-cylinder Aeronca or something, because the nine-cylinder Salmson is too hard to draw.

All in all, we have a fine representation of lightplanes in this issue and hope to keep it up indefinitely providing, of course, that our readers still continue to come across with the necessary dope and photographs. Our apologies go to Mr. Barnes for the belated publication of his ship, but this was due to the fact that this department was dropped for some time just to see what the reaction would be from our readers.

One of the ships in this issue has been very satisfactorily propelled by a converted motorcycle engine, three other lightplanes by converted Ford engines and yet the engineers still claim that converted engines are not good aviation engines! If these technicians could only see Pietenpol zoom up like a pursuit ship with an old Henry on board or see Corben gracefully flying the Super-Ace with one of Henry's productions at a minimum of cost and trouble, I feel sure that they would change their minds on this subject.

END.

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1/16x3/16	25c
1/16x¼	27c
3/32x3/32	25c
⅛x⅛	30c
⅛x3/16	50c
⅛x¼	55c
⅛x⅜	65c
3/16x3/16	50c
3/16x¼	60c
¼x¼	85c
¼x⅜	$1.25
¼x½	1.60
⅜x⅜	1.90
½x½	2.25

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⅛x2, 10 for	23c
3/16x2, 10 for	32c
¼x2, 10 for	42c
½x2, 10 for	75c

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1x2, each	15c
1x3, each	20c
1x6, each	35c
1½x1½, each	25c
2x2, each	25c
2x3, each	35c
2x4, each	45c
2x6, each	60c
3x6, each	$1.25

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1x1½x12	40c
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1⅝" dia., pr., per doz. 60c

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1¼" long, 3 for	15c
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2½" long, 3 for	30c
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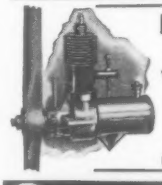

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TRADE—0x5 Robin, relicensed, brand new cylinder, steel propeller, Scintilla magneto, air wheels, turn and bank, etc. Also licensed Le Blond Aeromarine Klem in A-1 condition. Reasonably priced. Will trade for planes in poor condition or what have you?—Harold Clobes, Marshall, Minn.

I WILL PAY $3.00 and up for all kinds of homemade model airplanes, or will trade. Stamps for reply.—Bill Farr, Minnekah, Okla.

TRADE—Chrysler 75 Roadster, new paint job, six wire wheels, new curtains, Philco radio, in perfect condition, for a light plane in flying condition.—Kenneth Jacobson, 43 Woodruff Place, Perth Amboy, N. J.

FOR SALE OR EXCHANGE—Heath A-1 condition. Few hours flying time. Wanted: Licensed two or three place.—Andrew Gratson, 1156 Franklin Ave., Aliquippa, Pa.

SALE OR EXCHANGE—Monoprep Licensed to July 1936—$385. Will consider 3 or 4 place ship trade.—Dean Crites, 245 W. Main St., Waukesha, Wis.

MONARCH O.X.5 three place in excellent condition. Refinished relicensed air speed duals very stable. Value $450. Will trade for what? and some cash.—Wesley Brubaker, Freeport, Ill.

HEATH welded fuselage, tail grope, wings with alerons, 4 steel struts, landing gears, uncovered desk typewriter, twin cylinder air compressor with motor, .25 cal. automatic like new, for any type of plane that will fly or what have you?—George Glazier, 3901 Borden St., Cincinnati, Ohio.

TRADE—Northrop Glider nearly complete for late motorcycle or what have you? All letters answered.—Arlo Benson, Spencer, Iowa.

WANTED—Light plane less motor. Will trade 1929 Indian Scout Motorcycle. A-1 Condition.—Write William H. Tnett, Hummels Wharf, Pa.

WHAT IS OFFERED for a 80 H.P. Le Plane with new propeller, Crawford Power glider fuselage with wheel landing gear. One 18" band saw. One Santa Maria 3 ft. ship model.—Edwin Hageman, 42 No. Willow St., Montclair, N. J.

2 PLACE AERONCA. State condition, if creaked, price, or a good light eligible for license.—Kay, 249 Soquel Ave., Santa Cruz, Calif.

MOTORS, ENGINES, ETC.

FOR SALE OR EXCHANGE—Szekely 30 L. overhauled $75.00, less hub and prop. or $95.00 with. Ford A overhauled, unconverted $10.00. Gasoline model engine with prop., new, $5.00. Can build prop. for anything. Want welding outfit.—Marshall D. Webber, R. F. D. No. 3, Jefferson, Ohio.

WANTED—2 cylinder opposed engine—15 to 25 h.p.—2 or 4 cycle. What have you for cash or trade?—Walter Haufe, 414 Oak St., Neenah, Wis.

WANTED—Cheap motorcycle motor.—Jos. Mehl, Breckenridge, Minn.

MEAD GLIDER in good flying condition. Will sell cheap or trade for Model A Motor, dope, air wheels or what?—Prentice Brothers, Park Rapids, Minn.

FOR SALE—Three cylinder aircooled airplane motor. Turnes 6½ ft. propeller, 1800 R.P.M. complete with propeller. Price $60.00.—Ray Martin, Route 1, Sterling, Ohio.

WANTED—A Saimson AD 9 40—50 H.P. motor or a Continental A-40 or a Szekely 30-45 motor in good condition. State price and shape of motor in first letter.—Edgar McCarter, Union City, Ind.

MISCELLANEOUS, ETC.

SWAP—Have 39 Popular Mechanics Magazines starting January, 1930; also 50 back numbers of Popular Aviation. What do you have?—Burt Levi, 45 East 82nd St., New York City.

FOR SALE OR TRADE—Airplane negatives, photographs, magazines. What have you?—Roger Perrault, Lyndonville, Vt.

FOR SALE OR TRADE—Johnson "16" racing outfit, A-1 shape. Will consider plane or cycle of $150 value. Send pictures first letter.—Rusty Elliott, Bagley, Minn.

TRADE—Superb Burroughs electric posting machine (cost $1100 new) for a two or three-place ship in good condition, or you make some offers—will answer all letters.—Adrian Thompson, Tuscumbie, Ala.

WANTED—Motorcycle in good condition. Will trade Hisso A 150 H.P., perfect condition.—Carl Anderka, Cozy Theatre, Orange Grove, Texas.

DANDY 16 foot House car. Modern. 1 bed. Room for another. Want 2 or 3 place plane now flying.—R. E. Bouts, Haven St., Eaton Rapids, Mich.

40 WOOD, steel propellers—puller, pusher, all sizes. Instruments. Parachutes. Tubing. Motor mounts. Dope. Safety belts. Throttles. Oleos. Magnetos. Wheels. Landing gears. J5 motor. OX and Hisso motors and parts. Starters. Robin fuselage. Motorcycles (Austin radiator). Licensed OX jobs cheap—Trades, terms. Want J5 parts.—Miller Flying Service, Montclair, New Jersey.

YOUNG MAN 21—With good business training, wishes work in exchange for pilot's and mechanic's training, mechanically inclined, few hours in air, will go anywhere, consider anything, WRITE Arthur L. Stevens, 404 E. 10th St., Kansas City, Mo.

YOUNG MAN 19—High school education, clean, sober, energetic, ambitious. Would like to obligate himself to any reputable school, firm or individual in return for flying instructions and board. I'm willing to do anything. Won't some one please help me get started in this field I've loved for years? Please write to Bill Ward, Minters, Ala.

Airplanes Wanted

Advertise your wants in this column—the service is free. You are certain to contact the plane that you desire. The publishers, however, reserve the right to reject any or all notices at their discretion.

PLANE WANTED—I am in the market for a Velie monocoupe or a Curtiss Robin OX5. Must be licensed or eligible for a license. State full particulars in first letter with best price. I have a motorcycle and a good violin with case in addition to the necessary cash. Please write at your earliest opportunity.—ELMER M. EPFERD, R.R. 2, W. De Pere, Wisc.

CORBEN JUNIOR ACE WANTED, or a Pietenpol Air-Camper, with or without engine. A Waco 9 also considered. The planes must be in first-class condition. Send photo of plane and your best terms or cash price in first letter.—EDISON JONES, Jamestown, Tenn.

WANTED—A Curtiss-Wright Junior, less engine in any condition except a crackup. Will consider a plane with engine, however, if the price is right. State lowest cash price and full details in first letter.—E. L. HUFFINE, 1800 Ave. "G", Council Bluffs, Ia.

WANTED—A power-driven primary glider in good condition, with a one or 2-cylinder engine. Crackups or junk not considered. Send photo and best price in first letter.—D. HUTCHINS, 622 Boulevard "E", Weehawken, N. J.

WANTED—A One to 3-place ship needing recovering or other minor repairs—no crackups. I would like to have a Pietenpol Air-Camper, Kari-Keen or similar ship. I also want a small air-cooled engine, 30-65 horsepower. Please give full particulars, photo and price in first letter.—OLAV FOSTERVOLD, 15th Street, West, Willmar, Minn.

WANTED—An OX powered ship, American Eagle preferred. It need not be licensed. The ship must be cheap and owner must be willing to sell it on terms. I can also use a Szekely, Anzani, Ford, Aeronca or Lawrence engine. I have a Lincoln sport to trade or sell. It has need of covering, dope, etc. I also have a converted Ford engine with high-tension magneto, oil-pump, and deep oil case with a 6-ft. prop to trade.—ANDY CARFIELD STATION, ROY ANDREWS, Ganettsville, Ohio.

WANTED—A one or 2-place lightplane (3 to 7-cyls.). Send photo and lowest cash price. Must be cheap.—HOWARD PHILLIPS, Route 1, Winder, Ga.

WILL PAY $100 for a ship less motor, needing minor repairs. An OX Travel, Air or Velie job preferred. Must be eligible for license.—ORVILLE W. HENDRICKSON, 608 13th St., West, Willmar, Minn.

WANTED—Will pay $30 to $60 monthly, until paid for, on a two or 3-place open-type licensed ship. Prefer Great Lakes but will consider an OX5 Waco 10. References.—J. B. GUNN, JR., 746 4th Ave., Laurel, Miss.

VELIE MONOCOUPE or any other cabin monoplane (No OX) not more than $400 cash, and not more than 500 miles from Minneapolis.—E. D. SWANSON, 2624 Blaisdell Ave., Minneapolis, Minn.

XUM

Brand New Features!

THE December issue of POPULAR AVIATION contains many new features of outstanding merit in addition to the old features that have been so popular in the past.

First off, there is a humorous dictionary of aviation terms used by the pilots and mechanics. If you don't know the meaning of "blip", "squawk-card", "crab" or "kicker", you'll need this dictionary. Be up to date on aviation terms and airport patois, you may need them some day.

There are a lot of amateur lightplanes in existence, and most of you have seen or flown them, but in this issue we are starting out on a brand-new angle. Manley Mills, is going to describe the constructional details of an amateur "blimp" or dirigible, and we are sure that this will awaken your interest.

Then, Carl Ogilvie will be back with one of his famous war stories—and this will be good news to our war story fans. One of the best things about Carl Ogilvie's yarns is the fact that they are true authentic stories—not fiction. Accompanying this story will be—literally—a pack of World War planes that will arouse enthusiasm among the members of our paste and scissors club.

For the serious minded reader, and we haven't forgotten him, are numerous semi-technical articles dealing with lightplane design, gasoline driven models and engines. Winter is the time to study and learn and you will find this section a veritable institute.

The front cover will carry a fine color drawing of Benny Howard's famous plane, "Mister Mulligan" which will be prized by all air-race fans and collectors of airplane pictures.

20 More Army Insignia

WITH COMPLETE DESCRIPTION OF SQUADRONS, HISTORY, ETC.

All in the

DECEMBER

Issue

Waterman

(Continued from page 288)

Due to the type of landing gear used in the Waterman plane, primarily, a safe margin of minimum gliding or flying speed over stalling speed has been reached. Brakes, always a difficult thing to apply to any plane, and more difficult to use, are a part of the new type tailless plane, and can be applied at a speed of 80 miles per hour. Though the top speed of the job is 114 miles per hour, it can be landed at a speed of 30 miles per hour!

Another feature of the new type is the ability of gliding straight into a landing without any flaring near the ground, which removes entirely the need of any accurate judgment of height above the ground, one of the chief troubles of most pilots.

That landing feature alone, it is estimated by officials, will result in the saving of no small number of student lives throughout the land. Last year, more than twenty pupils on early solos were killed by misjudging slightly their distance above the ground and crashing. It is practically impossible to get into trouble in landing with the Waterman plane, except by actually running into a obstacle. And that happens very rarely.

Its landing safety was emphasized the other day when the left landing gear buckled after the plane had been landed, and resulted in the craft swinging around in a half circle without damage beyond the undercarriage member which gave way.

The second greatest asset of an airplane, beside its inability to spin, is its ease of pilot visibility. The Waterman plane, in many ways, affords better visibility than the open cockpit planes of pre and just after war days. Its front is practically all shatter-proof glass.

The interior is heated in winter, and while the windows cannot be opened. ventilation is provided for three persons. While the plane is designed for a normal two person load, it will rise with a load of 600 pounds, the approximate weight of three persons.

As for the spinning undesirability of most planes, due to crossed controls many times, this one presents a decided contrast. There are no controls that can be crossed and the plane cannot spin. In fact, except in rough air, only the rudder need be used to hold to the desired course, or turn.

The banking is done by the two vertical flaps at the ends of either wing, in much the same manner as the vanes of the autogiro. One merely pushes the rudder over. As the plane begins to turn, the wing tip on the outside becomes more horizontal, and the entire wing rises to suit the sharpness of the bank. When the rudder is snapped back straight the tips become vertical once more.

END.

High Lights

(*Continued from page* 298)

dustry to produce a medium sized commercial airliner to compete with American planes but only to withdraw the offer when, after some months, England had failed to produce a rival for airliners of the United States.

* * *

YOU don't look back any more, you look UP now when you hear someone say, "Pull over" and in New York you are liable to see Colonel Harold Fowler, First Deputy Police Commissioner, directing traffic and warning violating motorists over the short-wave radio broadcasts from the Goodyear blimp, Resolute. Chief Herbert Burns of the Cook County highway police does a similar traffic broadcast weekly from an airplane.

* * *

RECENTLY, Pilot Dick Field discovered that a landing-wheel of his plane had torn loose while he was flying over Cleveland with three passengers and he turned the controls over to 32-year-old Dick Long who had never piloted a plane before while Field, at the end of a rope weighted with a fire-extinguisher, hung from the struts and repaired the damaged wheel, later making a safe landing.

* * *

CLARENCE CHAMBERLIN, transatlantic flyer, who has been operating a weekend passenger service, expects to open a new airline operating between Holmes Airport, Queens and south of Boston with rates about equal to railroad fares and running time about one hour and forty-five minutes.

* * *

THE flying Key brothers, holders of the world's endurance record, are planning to lower the cross-country air transport speed mark. Ken Ringel and Ellis Frederich have had two forced landings on their attempts to break the Keys' 27-day endurance record but intend to take another crack at the mark while Col. J. J. Grady and Capt. Ralph Haines, commercial fliers of Washington, are making plans for a flight which would keep them in the skies for 60 days.

* * *

OIL trouble caused the failure of the flight which Signmund Levaneffsky, Soviet pilot, was attempting over the North Pole to United States. He announces he will try it again. T. Campbell Black, flying a Comet plane similar to that in which he and Charles W. A. Scott won the London to Melbourne derby, is attempting to break the airplane speed record from England to Capetown, South Africa, a 14,000-mile flight.

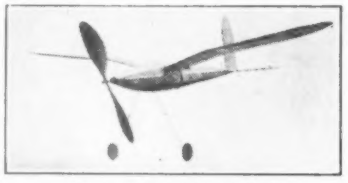
Frank Kurtz, junior pilot of Los Angeles, has completed the first junior flight of 1,200-mile three-nation course flying over Caliente, Mexico, fourteen hours after leaving Victoria, B. C.

Sir Charles Kingsford-Smith, Australian flying ace, succeeded in raising sufficient funds to redeem his famed plane, Lady Southern Cross, which had been attached by a creditor. Maurice Arnoux, French speed ace, has broken his own world's record for a 100-kilometer flight when he established a new mark of 295.792 miles an hour for the distance.

This is a whole lot better than we are doing on this side of the water—wonder why?

END.

YES--YOU WANT



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